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PROF. ALEX. M. FISHER of Y. COL.

Lost in the ALBION April 22d 1822.

THE

AMERICAN

JOURNAL OF SCIENCE,

AND ARTS.

CONDUCTED BY

BENJAMIN SILLIMAN,

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PREFACE.

A TRIAL of four years has decided the point, that the American Public will support this Journal. Its pecuniary patronage is now such, that although not a lucrative, it is no longer a hazardous enterprize. It is now also decided, that the intellectual resources of the country are sufficient to afford an unfailing supply of valuable original communications, and that nothing but perseverance and effort are necessary to give perpetuity to the undertaking.—The decided and uniform expression of public favour which the Journal has received both at home and abroad, affords the Editor such encouragement, that he cannot hesitate to persevere—and he now renews the expression of his thanks to the friends and correspondents of the work, both in Europe and the United States, requesting at the same time a continuance of their friendly influence and efforts.

YALE COLLEGE, Sept. 25, 1822.

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ERRATA TO VOL. V.

Mr. Barnes on the Canaan Mountain.

Page, 11, 3d line from bottom, for *squamosa*, read *squarrosa*.
" 15, line 10 from bottom for *sunken*, read *sunk*.
" 7, between "part" and "of" read (an omitted clause) *of the same range and.*

In the explanation of the plate, line 8 from bottom, for *Jones'* read *Janes*.

THE

AMERICAN

JOURNAL OF SCIENCE, &c.

GEOLOGY, MINERALOGY, TOPOGRAPHY, &c.

Art. I.—*A memoir on the natural Walls, or solid dykes, in the State of North-Carolina; about which there have been debates, whether they were basaltic, or of some other formation;* by John Beckwith, M. D. *fellow of the College of physicians in New-York, &c. to Samuel Mitchell, M. D. & P. &c. dated Salisbury, North Carolina, December* 18, 1821.

[Communicated for this Journal.]

Dear Sir,

I received your letter of the 3rd of Oct. and have, agreeably to your request, put up a set of the specimens taken from the different basaltic walls in this neighbourhood, illustrative of their formation. You will probably receive them shortly by one of the coasting vessels from Wilmington to New-York. You also expressed a wish that I would communicate such information, connected with their history as might be in my possession; and referred me to several Vols. of the Medical Repository, for what had been written upon the subject. I had read and compared the descriptions given by the Rev. Dr. Hall, and the Rev. Zach. Lewis, with the walls themselves, and found them in many particulars correct; and I cannot perhaps better convey my own views than by quoting occasionally from them. I shall not however attempt to discuss with these gentlemen, the question of their origin or nature: it is a matter so completely

within your province, and with which you are so thoroughly acquainted that it would be but "discoursing on war in the presence of Hannibal."

The wall discovered first, was about twenty-seven years ago, exposed to view by repeated heavy rains washing a deep *ravine** in the side of a hill of moderate elevation, upon the south branch of the Yadkin River, about eight miles from Salisbury. It is described by Dr. Hall, as being "composed of small stones, laid in white cement, resembling lime of a very fine texture. The largest stones do not exceed twelve pounds in weight, and from that of all sizes down to the weight of an ounce. Specimens from this wall are marked No. 1—the length of these peices makes half the width of the wall, and they are preserved together, precisely as they were taken from it. The aid of a mattock is required to loosen some of them, others may be pulled up by the hand. The species he says is what the Irish call *black whin*, nor is there any other kind of stone to be found in the wall. Mr. Lewis remarks that "the ends of the stones, which are of different figures, form the sides of the wall. Some of the ends are square, others are nearly of the form of a parallelogram, triangle, rhombus, or rhomboides; but most of them irregular. Some preserve the figure and dimensions of the end through the whole length; others enlarge or diminish from the end. The surface of some is plain, of some concave and of others convex. Every concave stone is furnished with one of a convex surface. When the stones are not so exactly fitted as to lie perfectly level and firm, they are curiously wedged with others, which are very small, and of a plano-convex form. The most irregular and unmanageable stones are thrown into the middle of the wall. The whole appears to be arranged in the most skilful manner to make the wall solid and strong." The idea is I think, rather fanciful than correct. A close inspection of the specimens will I believe satisfy you that these little pieces possess that kind of regularity, and conformity to the larger ones, which made them necessary and constituent parts of the solid formation, prior to its separation. He again remarks, that, "every stone is covered with a species of cement. The cement contiguous to the stone, has the appearance of iron rust; and where it

* I use this word for want of an English one to express my idea.

is thin, the rust has penetrated through it, many pieces, however, are found more than an inch thick. In these the cement appears to be of a fine and curious texture; not the least sand or grit is discoverable. In the wet parts of the wall, the middle of the cement which is not discoloured with rust is nearly of the colour, the consistence and soft oily feeling of putty in its softest state. The width of the wall is uniformly twenty-two inches; its height and length have not yet been discovered." All the stones, you will find in various stages of progressive decomposition—some small ones I have found so completely decomposed as to be easily broken by the fingers. The ends of the stones you will observe are incrusted in a similar manner with the sides. The course of the wall is N. East and S. West,—it is enclosed on each side by soft, coarse, granite. Mr. L. further remarks that, "about six or eight miles from this wall, another has since been found, which is forty feet in length, four or five in height, and uniformly seven inches in thickness. These stones are all of one length, but of different kinds. Some are of the iron character, others of a light grey colour, and differing as widely in kind as in colour." There is considerable inaccuracy in this statement, and it may be well to correct it; as it would tend to improper conclusions, and throw the subject into still greater obscurity. About five miles south-east from the above described well (at Robleys,) and four miles north from Sailsbury, near Coquenowers, the rains have washed a furrow in the side of a hill, (as in the former case; and as is indeed, very common in this part of the country,) to the depth of several feet. At the bottom of this is found a wall of precisely similar structure, with the exception of its size. Its course is likewise North-East and South-West. The stones (see specimens No. 2.) are six or seven inches in length, lying across the wall, and forming its width. On comparison, you will find them differing in no respect, in colour, kind, or texture, from those at Robley's nor from each other. This wall is likewise embraced on each side by loose granite; neither its length, nor depth, have been ascertained, nor has any one thought it worth while to engage in a search, likely to prove so unprofitable and indeterminate.

In the course of one of my professional excursions in the country, in 1819, I discovered traces of this stone on the

declivity of a hill, over which the States-ville road passes, half a mile beyond Second Creek, near Gillehans, eight miles from Salisbury. In order to gratify my curiosity, I obtained some hands from a plantation in the neighbourhood, to explore it some short distance. Within twelve inches from the surface, I found a wall pursuing a North-East and South-West course, constructed in the same manner with the others. The stones (No. 3.) lie across the wall, which is about seven inches wide. It possesses all the properties which characterize the others, whether of regularity, colour, and texture of the stones, cement, or any other circumstance. This is also embraced by coarse gravel. My time did not permit me to pursue it to any considerable depth or extent. Two miles South of Robleys, on the plantation of Daniel Biles, I found a vein of it crossing the point of a hill, the specimen is marked No 4. On the Charlotte road nine mile S. S. West from Salisbury, and four S. West from Gillehans, it again makes its appearance on the surface of the ground, ; specimens marked No. 5. About a mile from Town on the East, I have lately discovered a wall of similar construction. It makes its appearance in a gutter, worn by the rains in their descent by the highway, on a gentle declivity,—the specimens are marked No. 6. There are many other places, some on the North side of the main Yadkin, to which I could refer if necessary, where there are evident traces of similar veins; most of them lie very near or upon the surface, and a person tolerably familiar with their appearance, can detect them without difficulty. They all, so far as my observation extends, observe the same general course, viz. N. East and S. West. None of these stones are to be found in any part of the country, except in or near these veins.

I have declined meddling with the discussion, touching the question of the origin or nature of these Dykes; but if I might be permitted to express an opinion upon the subject, it would be widely different from the one advanced by both these reverend gentlemen. They seem to have no difficulty in arriving at the conclusion that these walls are the result of human skill and industry, and have indulged in a number of curious conjectures as to their probable design. The opinion given by the late Dr. Woodhouse, professor of Chemistry in the University of Pennsylvania, in his reply

to Dr. Hall, would seem to me much the more rational and philosophical, viz. that they are basaltic. Although the position of these walls is in some degree an anomaly in the history of basaltes, yet I think there is sufficient analogy for the support of the opinion. The comparative analysis by Dr. Woodhouse of these stones, *rust and cement*, (see Med. Repos. Vol. II. p. 259,) with those made by Bergman, Monges and others, of the basaltes of other countries; the perfect unity in kind, of all the stones in the same wall, and the near resemblance they bear to the specimens of basalt in my possession, together with the following description given by Cleaveland, render the thing conclusive in my mind.

The most common colour of Basalt, says Professor Cleaveland, "is greyish black, sometimes inclining to brownish grey, and sometimes to brownish or bluish black. Some varieties have a tinge of green. The exterior is often brown, or reddish brown, in consequence of decomposition. The colour of its streak is a light grey. It is opaque, or sometimes feebly translucent at the edges. Its fracture is usually uneven or fine splintery, sometimes a little conchoidal, earthy, or nearly even. It has no lustre, unless from the presence of foreign substances. It is difficult to break, and frequently sonorous when struck. It is more or less subject to decomposition, partly, at least, in consequence of the action of the atmosphere upon its Iron, which exists in a low state of oxidation, as is evident by its action upon the needle. Hence the brownish, friable, or even earthy crust, which often invests its exteriour. Those Basalts, which seem to approach very near to green-stone, decompose most rapidly. Indeed the whole mass is sometimes converted into an earthy, argillaceous substance." Mr. C. however, thinks it extremely doubtful whether any basalt, strictly speaking, has yet been discovered in the United States, but that the columnar and prismatic masses which exist in various parts of the United States, are undoubtedly a *secondary basaltiform greenstone*, which, in some cases, may perhaps be *passing into* basalt.

If then the fact be established, that these stones are basaltic, I presume it will hardly be contended that they were collected from, nobody knows where, to form a number of parallel walls, of a length and depth which no man can calculate.

As to the question of their origin, whether aqueous or volcanic, I dare not, with my limited knowledge of Geology, hazard an opinion. I would however, with great diffidence, and with submission, question the correctness of Dr. Woodhouse's decision. He believed them to be of volcanic origin, and founded his opinion upon a belief that there are volcanic appearances in this section of country. Such there may be; but I have never heard of, or seen any traces which could lead to such a conclusion. If they had their source in one common point, would not their course be divergent rather than parallel, especially as they are several miles apart? Does not the fact that they observe the same general course with the great range of mountains in this country, and of our atlantic coast, argue something in favour of a belief that they are an aqueous deposit?

In the box you will find some small specimens of kaolin (No. 7); my largest pieces I some time since sent to Professor Olmstead, of our university, and have not since had an opportunity to obtain more. It is found on a spur of the Tryon mountains, called Flat-Swamp mountain, running up north from the narrows of the Yadkin river, to within seven or eight miles of Lexington. The summit is composed of granite and quartz chiefly. On the sides this clay is found in immense quantities, thinly covered with gravelly earth. The foot of the mountain on the East, together with the plain below, is covered with this clay in fine powder, washed down by the rains. This plain had long been the resort of cattle for the purpose of licking the absorbent earth, particularly in the spring. People in the vicinity considered it a *salt-lick.* Accordingly, when during the late war salt became a scarce and expensive article, their attention was directed to this spot, as likely with a little labour and expense to furnish a supply, and become a source of considerable revenue. About this time a crafty fellow, a miner from some part of Europe, passed this way, and determined to convert their credulity into ready money, if he could not their clay into salt. He sunk a shaft about sixty feet, then commenced boring, and pursued it to the depth of eighty feet more. Their funds or their patience were now exhausted, and their suspicions of fraud awakened; the knave, pocketing his wages, coolly told them that, *if they would go deep enough*, they would be sure to find salt, and walked off.

In the course of their digging they passed through a thick bed of roof slate, of a dark bluish colour. Indeed, this section of country abounds in beautiful slates. Broad veins of it may be found running in various directions from this mountain, chiefly South-West; it is slightly inclined to the North. Some cross the river, and run through the country to a considerable extent.

No lime-stone has been found in this county, except a small quantity of the species called Tufa, specimen No. 8, which I discovered in the neighbourhood of Salisbury. I likewise send you some petrifactions of shells, found in great abundance on the plantation of the Hon. William C. Love, near Knoxville, East Tennessee, and presented to me by him. You have doubtless received many from that country before; but one of them is to my view of so curious an appearance, that I cannot withhold it (see No. 9). If we did not know that the species of fungi called toad-stool, are subject to such rapid decay as to render them improbable subjects for this process, I should strongly suspect it was one of them.

In this rapid sketch, I fear I have but very imperfectly answered your queries. If however, the information contained in it should contribute to settle the once violently agitated question concerning the nature of these walls, and correct the erroneous opinions entertained by many respecting them, it may not be wholly useless. Should you think proper so to arrange and dispose these materials, as to answer this or any other purpose, they are perfectly at your service. With the highest respect

for your literary and private character,

I am, dear Sir, your most ob't serv't,

JNO. BECKWITH.

Saml. L. Mitchell, M. D.

President of the New-York Lyceum of Natural History.

ART. II.—*A Geological Section of the Canaan Mountain, with observations on the soil and productions of the neighbouring region; by* D. H. BARNES, M. A. *member of the New-York Lyceum.*

Read before the Lyceum, January 14, 1822.

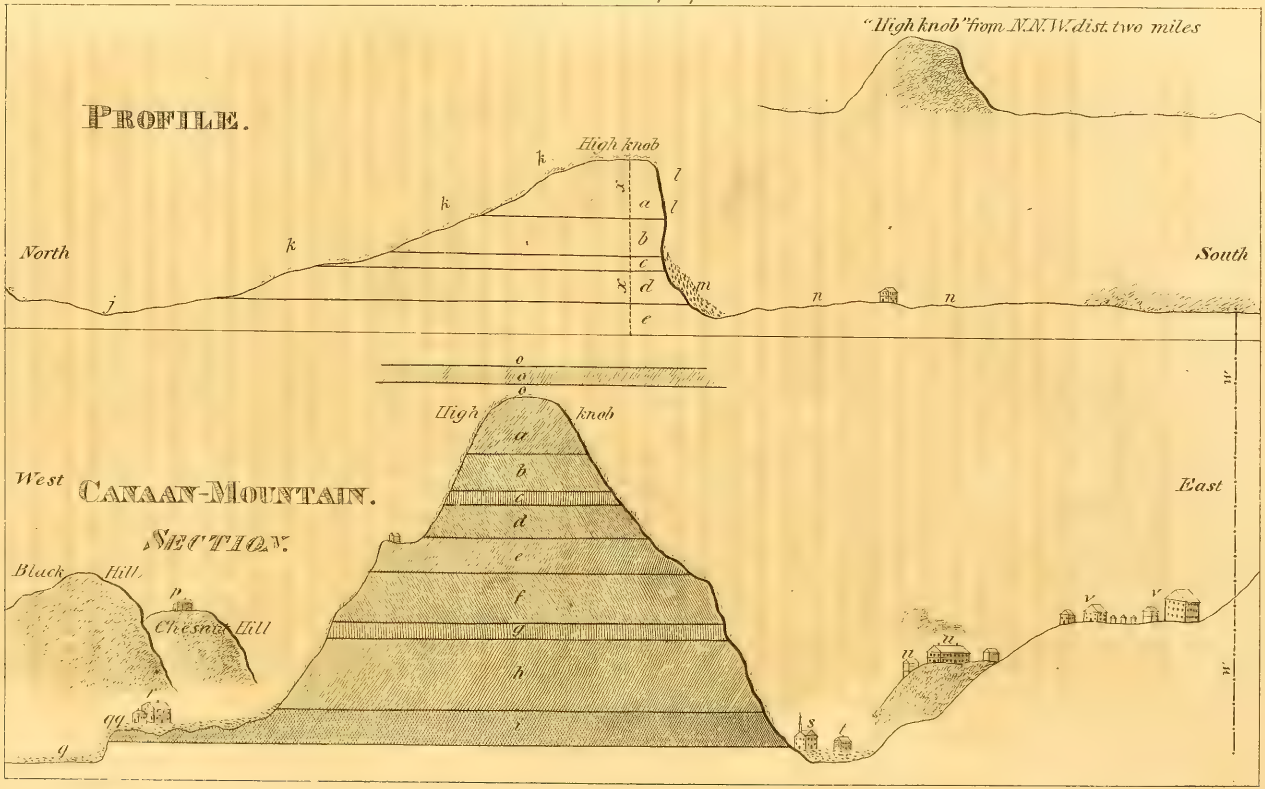
CANAAN MOUNTAIN is situated three miles south-west from the Lebanon springs, in the county of Columbia, and state of New-York. It is an insulated ridge of about four miles in length, from north to south, bounded on the north and east by the valley of Lebanon; on the south by a triangular lake, of about two miles in extent, called Whiting's Pond; on the west by a tract of low meadow land, on a part of which is a deep quagmire, with a pond of water in its centre, called Adgate's Pond. Contiguous to this swamp, on the south-west, is another, containing about twenty acres of surface, in the centre of which is a *prairie*, which according to tradition, was formerly covered by a *beaver pond.* From Adgate's pond a stream flows north, and another south. These meet in the Kinderhook river, a branch of the Hudson.

The height of the mountain from its immediate base,* does not exceed one third of a mile. The line of our section crosses the highest point, known in the vicinity by the name of *the high knob*, about fifty rods north of the line which divides the townships of Canaan and New-Lebanon. Commencing on the western side, in the low grounds before mentioned, the first remarkable object that strikes the observer is an extensive bed of *peat*(a)† It abounds in the adjacent swamps, so much that the quantity has been judged sufficient to supply the town with fuel for a thousand years. Specimens of this, and of the other minerals mentioned in this description, are on your table; and I have the pleasure of presenting them to the Lyceum. This *peat* is not at present used as fuel, on account of the abundant supply of wood which the yet uncultivated mountain affords. An attempt was made in the years 1803 and 1804 to bring the ar-

* The base itself is high land.

†These letters refer to the subjoined catalogue of minerals presented at the reading of this paper.

Mr. Barnes' Paper pa. 8



ticle into the market; but it failed, and has been since abandoned. The opening for this purpose, was made by Jesse Torrey, on the land of Andrew Hunter, in the township of New-Lebanon, about half a mile north-west of the springs. The peat of the upper part of the bed is coarse and light, but at the depth of three feet its texture is fine and compact, and its colour a deep chesnut brown. It burns with a clear white flame, and in general resembles that described by the Rev F. C. Schaeffer, in the Am. Jour. of Science, Vol. I. pp. 139 and 140. The peat of this region is supported by a *fine blue clay*, remarkably viscid and tenacious, and free from all other substances. It is used for setting vats and cisterns, and is a good material for making brick. The soil of the low grounds is well adapted to the growth of grass, and where it can be sufficiently drained, to the growth of grain also. The prairie is surrounded by an abundant growth of swamp ash, *Fraxinus Juglandifolia;* elm, *ulmus Americana;* soft maple, *acer rubrum;* and alder, *alnus serrulata.* The shrubs are chiefly berry-alder, *Prinos verticillatus;* several species of willow, *salix;* and spice-bush, *Laurus Benzoin,*

Ascending the FIRST STEP* of our section, we find a solid table land of a clayey loam. It is a good strong soil, but tough, and of difficult cultivation. Wheat and rye sown on it are frequently "winter-killed." The surface is overspread with bowlders of gray-wack(b), and *white quartz*(c). The gray-wack appears to be the ruins of an extensive stratum not at present found in place, any where in this region, to which my observations have extended. It is of the coarse granular kind denominated rubblestone,† and appears to have had its position immediately *above* the *highest* rock in our section. It is sometimes of a *porphyritic structure*,(d) as appears from the specimens before you. Wells sunk in this table-land give us frequent opportunities of observing the *sub-soil*, or what the farmers call the "*hard-pan.*" It is the blue clay of the peat bottoms with a large admixture of gravel, so firmly cemented as to render it difficult to be broken up with a pick-axe. Wells of the usual diameter, are sunk to any required depth without the least danger of "cav-

*See the plate. †Eaton.

ing in." The substance thrown out is totally unfit for vegetation, and has been known to lie exposed for forty years without acquiring a turf. The roots of no tree penetrate the *hard-pan.* The white-pine, *Pinus strobus*, marks most distinctly the first elevation from the peat bottom. In this situation it shoots forward its roots to a great extent horizonitally, and when this majestic tree is prostrated by the wind, the subjacent clay is discovered impressed, but not penetrated, by the roots.

At the SECOND STEP of our ascent we meet the first rock which occurs in place. It is limestone,(e) and probably one of the oldest members of the *transition class.* It ranges north and south, and dips to the east, with an inclination in various parts of from twenty to forty degrees. It makes excellent lime; of which, in former years, large quantities were burnt for building. It is of a beautiful light blue, fine grained, nearly compact, and receives a good polish. It was formerly wrought for the New-York market. It was sold at one dollar the square foot, and can still be seen in houses built twenty-five or thirty years ago. Six quarries were opened, from one of which slabs were taken out fourteen feet in length. The rock presents perpendicular fissures parallel to each other, which are crossed at right angles by natural joints. It also shows on the sides of the fissures, very regular and convenient divisions into tables, which require only the driving of wedges to be separated. It is thus easily quarried, after removing the incumbent substances, which are chiefly earth, and an inferiour kind of limestone,(f) which contains an admixture of very fine silicious particles. It is this, or a very similar rock from a locality five or six miles east of this, which was brought last summer to this city, under the strange delusion of its being "*Plaster*" (gypsum.)

On the margin of a brook in this vicinity, is found a very *fine sand*,(g) which may perhaps have been formed by the disintegration of the silicious lime-stone. The sand is so very fine as to appear to the naked eye like clay. Under the microscope however, it shows its real character. It is used, instead of Tripoli, for cleaning and polishing metals. It has been tried in this city, and answers the purpose well. Specimens of this last mentioned rock, from the out-burst of the stratum, on the *east* of the mountain, are before you.

They exhibit an uncommonly regular rhomboidal fracture.(h) They effervesce briskly with acids, and give fire freely with steel.

By taking an *offset of four miles North*, from the place of our section, we discovered the stratum on which the limestone rests. It is the *Lebanon roofing slate*, (i) which being of an excellent quality has been extensively wrought and transported to this city. It is inclined to the East, at an angle of about twenty degrees, and as it occupies the face of a side hill, of the *same inclination*, it is easily quarried. It is traversed at considerable distances by parallel seams of white quartz.(i) The formation is so perfect that slates of thirty square feet of surface, are frequently taken out, and much larger tables might easily be raised if required. South-east of this quarry, and distant about one mile, is the celebrated *Lebanon Spring** in *limestone*(j) which from its dip, direction, inclination, structure, and geological position, appears to be the same as the rock of our section. It ranges north and south, and inclines to the east, with an angle of twenty-five degrees, while all the other rocks, which I have observed in the adjacent region, dip towards the *south-east*, and range north-east and south-west. It was this remarkable difference in the stratification, that first attracted particular attention to the insulated ridge under consideration. *The soil* of the limestone is good where it is of sufficient depth, but throughout the greater part of this tract the rock approaches too near the surface.

The *principal trees* of this tract are beech, ***Fagus ferruginea;*** sugar maple, ***Acer saccharinum;*** dogwood, ***Acer striatum;***(shrub) chesnut, ***Castanea Americana;*** birch, ***Betula rubra;*** walnut, ***Juglans squamosa;*** butternut, ***Juglans cinerea;*** ironwood, *Ostrya virginica;* witch hazle, ***Hamamelis virginica;*** sassafras, ***Laurus sassafras.*** The *vitis*

* The waters of this spring have been analyzed by Prof. Griscom, and his analysis published in Bruce's American Mineralogical Journal, page 156. It has lately been discovered, that a soft friable substance resembling Tufa, has been deposited from the water. On digging in the canal that forms the outlet of the spring, and on which Tryon's Mill stands, this substance(v) was thrown out in considerable quantities. This deposit differs from the high rock at Saratoga springs,(x) by its more uniform colour, by being lighter, softer, more friable, and containing little or no iron, which abounds in the Saratoga Rock.

vulpina or frost grape grows abundantly, and overtops many of the trees of the second growth. The limestone rocks are the favourite haunt of the *helix albolabris of* Say the common snail, retaining the same manners as in ancient times, "*inter saxa repentes*."*

The third step in ascending Canaan mountain, brings us to a thin stratum of *white quartz*, which appears to have furnished the bowlders before mentioned. This rock is *tabular*, the tables standing very nearly perpendicular, and in many places it exhibits regular crystals on the edges(k) of equal thickness with the tables. The specimen(c) before you has a surface of fifty square inches, and is about one inch thick. This was procured at the surface and detached with a crow-bar. By making a small excavation, and using wedges, it is believed much larger tables might be obtained. This rock mixes on the one side with the *limestone*(l) and on the other, with *argillaceous slate*(m) which is the *fourth stratum of our section.* This slate presents a considerable diversity of colour and structure. Some of it is soft and earthy, while other specimens are hard and flinty. Its colours are light grey, green, ferruginous, and dark blue approaching to black. Some specimens both of the limestone and the slate are glazed on their edges with *talc.*(o) *crystals of pyrites*(p) are numerous, and some of them are an inch in diameter, but have very little or no lustre on their faces. They seem to have been formed before the slate, which is in many instances *bent round them.*(q) This slate covers all the hills of a moderate height in the vicinity. The soil of these hills, which was formerly esteemed very poor, is now much improved† and constantly growing better; while the contrary is observed of the valleys, which will probably continue to deteriorate, until our farmers shall learn to plough fewer acres, and manure those better. The timber of this part of our section and that which grows on corresponding heights of the circumjacent hills is principally chesnut, *castanea Americana;* much used for fences and building; white birch, *Betula papyracea;* white oak, *Quercus alba;* "the most useful timber tree in America;"‡

* Vide Sallust. Bell. Jug. Cap. xciii.

† See Spafford's Gazetteer, and Eaton's Index. ‡ Eaton.

black oak, *Quercus tinctoria;* red oak, *Quercus rubra, et coccinea.* The springs, which flow from the slate rocks, are remarkably pure water, and much esteemed for their *softness* and salubrity, the more so by contrast with the limestone water below, which is very hard.

This slate, in the township of New-Lebanon, assumes that variety called *alum slate.*(r) It is found on the land of Nathan Patchen, north of the springs. It occurs in a high and almost perpendicular bluff from the interstices of which constantly exudes the aluminous matter incrusting the specimens before you. It is highly acrid to the taste, and may probably become useful in the arts.

The fifth step is Graywack slate(s) which caps all the *high* hills in the vicinity, and is the uppermost stratum, known in place on the mountains which lie immediately west of the primitive region of New-England.

Above the Graywack slate, as formerly hinted, the Graywack rubblestone appears to have had its position. It is evidently the result of mechanical deposition, and answers perfectly to the description of this rock given in the New Edinburgh Encyclopædia, under the head of Mineralogy. The remains show that the stratum must have been of very great extent, and probably of vast thickness. Masses of this rock are found of from ten to fifty feet in diameter, and of a weight resisting any ordinary human force. By taking advantage, however, of their natural composition, they are easily removed, whenever they are opposed to the course of a turnpike, or impede the erection of a house. The method is simply to build a large fire, of dry logs upon them. The argillaceous cement is contracted by the heat, and the mighty mass is split into a thousand fragments. These fragments are commonly of a trappose form and thus become exceedingly useful for fences and buildings. *From the Graywack slate upward, the strata are repeated in the same order as before enumerated*, viz. *limestone*,(e) *quartz*,(c) *argillaceous slate*,(n) and *Graywack slate.*(s) The last forms the highest part of the "high knob." The appearance is the same as it would have been, if a large mass, of the same range, had been raised from its bed, and piled, like Ossa on Pelion, upon the top of the mountain.

The Peak is of tolerably easy ascent from the north,* but on the south the beetling crags overtopping the highest trees are wholly inaccessible. The eastern and western sides are precipitous, but can be ascended with care and labour by taking hold of the shrubs and projecting points of the rocks. The large mass of Graywack slate that caps the summit is stratified and inclined towards the south-east, differing in this respect, from every rock below it. The timber on the upper half of the mountain is similar to that on the lower half. The white pine which grows at the bottom, appears again in the middle region, where the limestone is repeated. The summit is crowned with pitch pines, *pinus rigida;* with an undergrowth of blue and black whortleberries, *vaccinium frondosum et resinosum.* This is an elevated and bleak region, and the rocks as well as the stunted trees, appear to bear marks of the pelting storms, and to have grown hoary, by the lapse of ages. Every thing here reminds us of the grand elevation to which we have attained. The quickened respiration, the sharp blast that whistles through the moss-grown pines—the absence of nearly all the tenants of the woods, both winged and quadruped—the lengthened prospect, and extended horizon.

The prospect is worthy of the toil required to obtain it. We look down as on a map on all sides. Turning to view the path by which we ascended, the house at the base of the mountain appears under our feet. At a little distance on the right, Adgate's Pond shines like a silver basin, through a nook of the mountain. On the left, the regularly planted orchards, and the richly cultivated fields, present the beauty of a garden, and the softness of a picture. The meadows beheld with a bird's-eye view, exhibit the smoothness of a level lawn. The woodlands appear like scattered clumps of trees designed to adorn a pleasure ground. The whole is so perfectly in view, and so diminished in size, that we can scarcely believe it to be of its well known extent.

> "'Tis distance lends enchantment to the view,
> And robes the" landscape "in its" magic "hue."

On the north-east "the vale of Lebanon," celebrated by travellers for its romantic beauty, thickly scattered over

* See profile.

with houses, and gardens, and orchards and groves, presents the beauty of a populous village, and the variety of a cultivated country. On the east, Hancock mountain rises with a bold swell, adorned on the side nearest the observer, with the village of the New-Lebanon Shakers, visited by every traveller, and celebrated for its peculiar neatness and simple elegance—for its rich gardens, and highly cultivated fields—for the regularity of its buildings, and the elegance of its manufactures—for the celibacy of its inhabitants and the inoffensive simplicity of their manners. Beyond the vale of Lebanon, and distant twenty miles, *Saddle mountain* "the highest land in Massachusetts" rears its broad *double back* to the skies, and from its cloud-capt height looks down in grandeur on the inferiour world. Turning again to the west, and extending the view, we perceive the hills gradually declining, and catch a glance of the Hudson River at the distance of twenty-four miles, with the white sails of vessels on its surface, alternately appearing and disappearing, as they float in the wind. The richness and the variety, the sublime extent and picturesque beauty of this scene are equalled by few in our country. Beyond the Hudson, Catskill mountains robed in azure hue, and steeped in hazy distance, rise to view in long parallel ranges " height o'er height" to the clouds, and like Atlas appear to support the heavens on their shoulders. This grand panorama is bounded by one of the most sublime objects in nature, and the pleasure felt in the contemplation of the nearer view, yields to astonishment at the grandeur of the more distant prospect.

Disruption and sinking of the Strata.—The whole of the rock formation, described in this paper, appears to have been *broken off* from the primitive tract on the East of it, and to have *sunken down* about *one thousand feet perpendicularly.* We had no means of accurate admeasurement. We estimated the distance by comparing it with other ascertained and well known heights. Hancock mountain is a part of the same mean height as the Highlands of the Hudson. The average of the four highest points mentioned in Dr. Akerly's " Geology of the Hudson River" is fourteen hundred and seventy feet. Allowing the highest peaks to be one fourth higher than the mountain generally, we shall have eleven hundred feet as the permanent elevation. It would therefore

appear that the height of the Hancock or as it is often called Pittsfield mountain may be safely estimated at one thousand feet, and the strata seem to have fallen the whole height of the mountain. This appears from the position of the strata in the mountains. The lower stratum of limestone described in the section is at the same height on both sides of the Canaan mountain. It is associated with slate. This Limestone part of which is silicious, is found with slate on the top of Hancock Mountain. It was also observed on the top of a mountain in Lee, fifteen miles South-East of our section. These two strata thus associated on the *top* of Hancock, and at the *base* of Canaan mountain, may perhaps without impropriety, be considered as parts of the same original bed, which has been disrupted by some mighty force, and while the Eastern part remained firm, the Western has settled down to its present position. The roofing slate is probably primitive, but whether it is so, or not, its position must have been *above* the white granular Limestone of Pittsfield.*(y) This limestone is on the surface, and clearly a primitive rock. But the elevated table land of Pittsfield, is several hundred feet higher than the low valley of Lebanon, so that the strata must of necessity, either have been bent rapidly downwards, or broken off and fallen perpendicularly. That the strata have dropped in situ, and not bent downwards, as Prof. Eaton supposes, appears from the *horizontal* position of the great masses of mountain strata, in our section, and also from the fact that the slate is found at the same height, on all the circumambient hills; and the limestone at the same depth in all the circumjacent valleys, and the graywack at the same elevation, upon the neighbouring mountains. This last rock is, moreover *laid bare*, to a great extent in that part of the mountain which lies South of the High Knob. Here the whole formation is perfectly open to inspection. The upper surface is horizontal. This surface is composed of the upper edges termed in geology, the out-goings of the strata, for it must be carefully observed that although the rocks are stratified and the strata highly inclined, yet the great beds or mountain masses are disposed, above each other horizontally, and these beds or

*I take for granted the truth of the Wernerian theory, as it regards the general order of the super-position of the rocks. See President Maclure's Geology of the U. S.—Professor Eaton's Geological sections, and Professor Cleaveland's Mineralogy.

masses are termed strata when in general we speak of geognostic relations.* A curious miniature instance, of the stratification of which we are speaking, and one which corroborates our supposition, that the strata have subsided horizontally; was observed in the township of Chatham, four miles westward of our section. The road passes through a hill of slate-rock which has been excavated to open a passage. This slate like almost all the other rocks in this part of the country, is inclined south-eastwardly or *towards the ocean.* Parallel seams in this rock are filled by rhomboidal quartz,(aa.) which is perfectly horizontal in its direction. This quartz in its disposition, so exactly resembles the fibrous *sulphate of* (bb.) *Barytes* at Carlisle that at the first sight the impression was strongly made that it was the same mineral but on approaching the bluff, the illusion vanished. This quartz is very remarkable. The strata are horizontally not more than an inch or an inch and a half thick, parallel, and all the fragments, like those before you, of a regular rhomboidal form. The rock in which the quartz is disposed, is a soft argillaceous slate, which is so rapidly decomposing into the soil of the hills before mentioned. The supposition, that the strata have been separated, and that the western part has fallen down to its present level is confirmed by a reference to Maclure's sections which show in this range, the transition on the west reclining against the primitive on the east. In his northernmost section, the transition is lower than the primitive, in the next section, the two are of an equal height; and in the part which we are considering the transition is a little higher than the primitive. By a reference to Maclure's or Cleaveland's Map, it appears, that the line on which the two formations meet, runs north and south, from Canada to the highlands, on the Hudson. This line traverses the Green mountain. The two formations meet at its top. So here, the Hancock mountain is in the same range, as the Green mountain, and very near south of it, and the two formations meet at its top. The fact that the two formations butt against each other in a line nearly straight for more than three hundred miles, cannot perhaps in any other way, be so satisfactorily accounted for, as by supposing that some mighty convulsion has rent asunder the Continent from the St.

* See plate.

Lawrence to the Ocean. What that force was, that could operate with such tremendous energy as to rive "the everlasting hills," through a space of three hundred miles, may be left to the Plutonians and Neptunians to determine. That it operated from *beneath* is probable, and that after it had opened for itself a vent, and escaped through the rift, caused by its action, the rock-strata, of the Western part, fell into the cavity which had previously contained the imprisoned agent. This supposed disruption will account for the course of the River Hudson and its passage through the highlands: and also for the position of Lake Champlain, which probably at some more remotely distant period, was the outlet of the great inland sea that once covered the country above the highlands. That the lowest part of the fallen or subsided tract, should be at some little distance, from the line of its disruption might naturally be expected, for the western part, in falling, would impinge against the eastern, and be in some degree supported by it, causing the strata to bend and form a *hollow* on the upper surface. That *little distance*, on the grand scale of operations which we are considering is from twenty to thirty miles, and the *hollow* is occupied by Lake Champlain, and the River Hudson. If, as we have supposed, some mighty force operating from below raised up this tract, and while the part eastward of the rift remained firm, produced a disruption, it would be natural to expect that some *other traces* of its operation, should be found on the *other side* of the tract. Such traces, in fact are found and they are so distinctly marked, as to produce a powerful confirmation of our supposition. In the counties of Warren, Washington, Montgomery, and Saratoga, westwardly of the general course of Champlain and the Hudson, *exactly where we should desire* we find the western limit of this tract "butted and bounded" by the primitive through a distance of more than one hundred miles. On this subject I refer you to the respectable authority of Prof. Eaton, and to Dr. J. H. Steel's excellent treatise on the mineral waters of Saratoga, to which he has prefixed a geological Map with observations on the geology of the surrounding country. Steel says, pp. 11, and 26, "*The eastern* side of the *Palmertown* range (primitive) commences *abruptly* and in many places presents an almost *perpendicular front*, that rises several hundred feet above the level of the plain that skirts its base.

This plain, he describes, as either transition *slate* and *Graywack*, or in some small part, *secondary*, "approaching the *foot* of the *Palmertown mountain*" and "in this manner it continues *along the base* of the mountain." Eaton says, (supposing a force to have been applied beneath) "At this place it happened to break through them all at once, forming a north and south *fissure* of twenty or thirty miles in extent. All the strata on the east side of the fissure, *fell back* nearly entire and still remain so, with the compact *limestone* covering the whole, which in some places meets the *granite so closely that it may be compared to a board scribed up to a wall by a carpenter*." Eaton's index, 2nd Edition, p. 108.

No confirmation is *needed* in support of such respectable authority which, however, will be fully confirmed and illustrated by a personal inspection and examination of the country described.

We have before taken for granted the Wernerian order of superposition of rock-strata, we here remark further, that it does not appear probable that the transition, most of which contains no organic remains; or even a great part of the secondary, that, namely, which contains the petrified remains of marine productions, now extinct, is of later origin than that tremendous catastrophe of our globe in which "all the fountains of the great deep were broken up, and the waters prevailed greatly" and "exceedingly and all the high hills, and the *mountains* under the whole heaven were *covered*." If at the period when the continents were broken up" and submerged, and the earth and sea were commingled; the tract, of which we are speaking, sunk to a lower level than the adjacent tract of primitive, it would in that situation be protected from wearing down, while the higher and soft strata, over nearly all New-England, would be washed away. We say *nearly* all, for there are two small tracts, one of transition, and the other of older* secondary remaining. The secondary† lies in the deep valley of the Connecticut river, and the transition extends from Providence to Boston, on a level with the surrounding country. Both are in situations to be protected in the manner before mentioned.

* Or transition. † Old red sand stone.

If the earth on which we live is composed of "the fragments of an earlier world, confusedly hurled together;" and of that, even without revelation, we have demonstrative proof in every part; we need not wonder why New-England is mostly primitive, and New-York mostly secondary. Why the Catskills are gray-wack, and the Rocky mountains granite. Why the Ural mountains are quartz, and the summits of the Andes clink-stone.

When we contemplate the immense tracts of sand and alluvion, we cease to inquire what has become of the ruin rent from the ragged mountains, or furrowed out from the deep valleys. When we observe that the valley of the Nile is not alone a watered garden—that the valley of the Mississippi contains vastly greater tracts, scarcely yet emerged from the flood—when we see that Atlas not alone looks down on an ocean of sand—that the Rocky mountains have their Zahara on the east, of seven hundred miles broad, and of length unknown—when we survey the globe in its extent; and to that the science of Geology has respect—we cease to inquire what has become of the ruin produced by the demolition of mountains, and the destruction of continents.

Iron Ore.

The boundary between the primitive and the transition, is the depository of a very extensive tract of Iron Ore. The ore-beds in Kent and Salisbury,(dd) the beds in Lee,(cc) Richmond, Hancock, New-Lebanon,(ee) several in the counties of Rensselaer and Washington; the great *range* of iron ore in Vermont, and on Lake Champlain, exhibit evidences of a continuity in this formation of iron, from near the ocean to the St. Lawrence. This tract of iron ore ranges *north and south*, and, for aught at present known to the contrary, may extend to the *pole*, the central point of *magnetic* attraction. Are there, in other places, any similar instances of a *polar direction*, in the beds of iron ore?*

Accompanying this range of iron ore is a range of white granular lime-stone,(y) from the ocean to Canada. This is affirmed to be the true metalliferous lime-stone of authors.

*Immense beds of magnetic iron ore extend, with little interruption, from Canada to the neighbourhood of New-York.—*Bruce's A. M. Jr.* p. 81.

Lead Ore.

The blue limestone(e) of Canaan passes at some considerable depth into a lighter colored stone, approaching the white granular limestone of Stockbridge.(y) In the southern part of the township of Canaan, this limestone(t) is the gangue of a fine steel-grained lead ore(u). It was formerly wrought, but the expense proved too great to justify its continuance, and it is now abandoned, and the mine filled with water. Galena, mixed with pyrites, is found in abundance, in the southern part of the county of Columbia, not far from Ancram iron works. It is on the borders of the transition, directly south of that mentioned above. It is a very rich ore, but has not been wrought to any great extent.

Catalogue of Minerals illustrating the foregoing remarks.

a.	Peat, 1 Hunter's, 2 Adgate's swamp, New-Lebanon.	
b.	Gray-wack Rubblestone,	Canaan.
c.	Tabular Quartz,	do.
d.	Porphyritick Gray-wack,	do.
e.	Limestone,	do.
f.	Silicious Limestone,	do.
g.	Fine Sand,	New-Lebanon.
h.	Rhomboidal silicious Limestone,	do.
i.	Roofing slate, with white quartz seams,	do.
j.	Limestone,	Pool-Hill.
k.	Quartz Crystals,	Canaan.
l.	Quartz with Limestone,	do.
m.	Quartz with slate and crystals,	do.
n.	Argillaceous Slate,	do.
o.	Slate and Limestone with Talc glazing,	New-Lebanon.
p.	Cubic Pyrites with slate bending round them,	do.
q.	Pyrites in Slate with Talc glazing,	do.
r.	Alum Slate and native Alum,	do.
s.	Gray-wack Slate,	Canaan.
t.	Limestone from the Lead mine.	do.
u.	Limestone and Lead ore,	do.
v.	Deposite from Lebanon Springs.	
w.	Water-Lime from Onondaga and Carlisle.	
x.	High rock at Saratoga.	
y.	White granular Limestone,	Richmond.
z.	Iron ore from	do.
aa.	Rhomboidal Quartz,	Chatham.
bb.	Fibrous sulphate of Barytes,	Carlisle.
cc.	Iron ore,	Lee.
dd.	Iron ore,	Salisbury.
ee.	Iron ore,	New-Lebanon.

Art. III.—*On a singular deposit of Gravel; by Professor* A. Eaton.

TO PROFESSOR SILLIMAN.

Sir,

I have just taken the measure of a deposite of several hundred cart-loads of gravel, made by the river Hudson, on Monday, the 4th inst. thirty-four feet higher than the highest point to which it rose during the time of making the deposit. This apparently paradoxical statement may if particularly described, and deposited among other facts in your scientific store-house, contribute a "mite" towards the solution of some geographical phenomena.

This deposite, consisting wholly of coarse gravel, is on the east side of the great canal cut through the glazed slate rock for the sloop lock, two hundred feet west of my house at the Old-Bank Place, near the north boundary of the city of Troy. It is necessary to state that the canal commissioners have directed an artificial bay to be formed here; wherein the branches of the great western canal which first meet the waters of the Hudson are to terminate, into which sloops are to enter by the aforesaid lock. The lock is already erected about half across the river, from the western shore. It being unfinished in the eastern half of the river, the water is pressed with great force against the east bank.

I need not mention that the uncommon and long continued severity of the past season has formed the ice of the Hudson of uncommon thickness. It broke up suddenly here, and moved down on Monday the 4th, not with great velocity, but with a degree of force which seemed to threaten even the shores of solid rock. Pressing against the little rock promontory across which the aforesaid canal is cut, cakes of ice shot over, and soon filled the canal. Other cakes pressing against the bottom of these, crowded them up to a considerable height above the water. At length an enormous ice cake appeared, bearing on its back a great quantity of gravel. This began to press against the heaps of ice already formed, which bore much gravel also. Innumerable other cakes from behind, pressed on by the unconquerable waters of the mighty Hudson, soon forced the largest cake across the canal, and up the eastern bank, so that its eastern

edge extended thirty-four feet higher than the surface of the water, carrying up hundreds of smaller cakes to the same height. This mountain of ice having taken its stand here, is now melting away, and leaving the gravel on the bank, which it transported from the northern counties.

I do not record this as an uncommon occurrence. But since it seems to be a rule among geologists to trace the derivation of alluvial deposits to localities more elevated than those where they are found, it may be well to remind them of contingencies of the above nature.

Respectfully yours, AMOS EATON.

Troy, N. Y. March 12, 1822.

Art. IV.—*Honorable notice of Mr. Schoolcraft's memoir of a Fossil Tree.*

REMARKS.

In our last we published the substance of the Memoir of Mr. Schoolcraft on the fossil tree of the river des Plaines. Having been favored with copies of letters on this subject, addressed to the author by the three American Ex-Presidents, we presume, of course, that the public will be gratified by the perusal of the remarks of these distinguished men.

"Quincy, 27th January, 1822.

"*Sir*,

I thank you for your memoir on the fossil tree, which is very well written, and the conjectures on the process of nature in producing it, are plausible and probable. It is the most remarkable exemplification of petrifaction that I have ever met with, although I have seen many that I thought curious. I once lay a week wind-bound in Portland road in England, and went often ashore, and ascended the mountain from whence they get all the Portland stone which they employ in building. In a morning walk with some of the American passengers of the Lucretia, capt. Calehan, we passed by a handsome house at the foot of the hill, with a handsome front yard behind it. Upon the top of one of the posts of this yard, lay a fish coiled up in a spiral figure, which caught my eye. I stopped and gazed at it with some curiosity: presently a person in the habit and appearance of a substan-

tial well-bred English gentlemen, appeared at his door, and addressed me—" Sir, I perceive that your attention is fixed upon my fish. That is a conger-eel, a species that abounds in these seas. We see them repeatedly at the depth of twelve feet water, lying exactly in that posture. That stone, as it now appears, was dug up from the bowels of this mountain, at the depth of twenty feet below the surface, in the midst of the rocks. "Now sir," said he, "at the time of the deluge, these neighbouring seas were thrown up into that mountain, and this fish lying at the bottom was thrown up with the rest, and there petrified in the very posture in which he lay." I was charmed with the eloquence of this profound philosopher, as well as with his civility, and said that I could not account for the phenomenon by any more plausible or probable hypothesis. This is a lofty hill, and very steep, and in the road up and down, there are flat and smooth rocks of considerable extent. The commerce in Portland stone frequently calls for huge masses from ten to fifteen tons weight. These are loaded on very strong wheels, and drawn by ten or twelve pair of horses. When they come to one of those flat rocks on the side of the hill, where the descent is steep, they take off six or eight pair of horses, and attach them behind the waggon, and lash them up hill, while one or two pair of horses in front have todrag the waggon and its load, and six or eight pair of horses behind it, backwards.

I give you this history by way of comment on Dr. Franklin's famous argument against a mixed government. That great man ought not to have quoted this as a New-England custom, because it was an English practice before New-England existed; and is a happy illustration of the necessity of a balanced government. And since I have mentioned Dr. Franklin, I will relate another fact, which I had from his mouth. When he lived at Passy (near Paris) a new quarry of stones was opened in the garden of Mr. Ray de Chaumont, and at the depth of twenty feet was found, a shark's tooth in perfect preservation, which I suppose my Portland friend would account for, as he did for his conger-eel, though the tooth was not petrified.

Excuse this whimsical letter, accept my repeated thanks for your memoir, and believe me to be

Your obliged friend, and humble servant,

JOHN ADAMS."

MONTPELIER, Jan. 22, 1822.

Sir,

I have received the copy of your memoir on the fossil tree, which you politely forwarded. Of the decisive bearing of this phenomenon, on important questions in geology, I rely more on your judgment than my own.

The present is a very inquisitive age, and its researches of late have been ardently directed to the primitive composition and structure of our globe, as far as it has been penetrated, and to the processes by which succeeding changes have been produced. The discoveries already made are encouraging; but vast room is left for the industry and sagacity of Geologists. This is sufficiently shewn by the opposite theories which have been espoused; one of them regarding water, the other fire, as the great agent employed by nature in her work.

It may be expected that this hemisphere, which has been least explored, will yield its full proportion of materials towards a satisfactory system. Your zealous efforts to share in the contributions, do credit to your love of truth and devotion to the cause of science, and I wish they may be rewarded with the success they promise, and with all the personal gratifications to which they entitle you.

With friendly respects,
JAMES MADISON.

"Th. Jefferson returns his thanks to Mr. Schoolcraft for the memorial he has been so kind as to send him on the fossil tree of the river des Plaines. It is a valuable element towards the knowledge we wish to obtain of the crust of the globe we inhabit: and its crust alone is immediately interesting to us. We are only to guard against drawing our conclusions deeper than we dig. Mr. Schoolcraft is entitled to the thanks of the lovers of science for the preservation of this fact: he has those of Th. J. with his salutations of esteem and respect.

MONTICELLO, Jan. 26, 1822.

Art. V.—*Geology, Mineralogy, Scenery, &c. of the Highlands of New-York and New-Jersey. Read before the Catskill Lyceum of Natural History, by* James Pierce.

[Communicated for insertion in this Journal.]

General description and Geological character.

The elevated mountain range called the Highlands, is a continuation of a primitive chain, that commences in Canada, passes through Vermont, and forms the western boundary of Massachusetts and Connecticut.

The Highlands present parallel ridges, which pass from north-east to south-east, through the states of New-York and New-Jersey, crowned by many sugar loaf eminences, that form a waving profile characteristic of primitive regions.

The average width of the Highlands in the State of New-York is twelve, and in New-Jersey, twenty miles. The general elevation is greater to the west, than to the east of the Hudson. The Fishkill is the most prominent and extensive of the Highland ranges to the east of the Hudson. Most of the mountains on that side of the river, viewed from Mount Dunderberg, in Rockland County, appeared considerably below me, and the summits like the broken waves of of a tempestuous ocean. The prospect from Mount Dunderberg is extensive and interesting. The Hudson is in view to the south for thirty miles. I overlooked the well-tilled region of Westchester county, and traced the towering greenstone range which forms the western border of the river. The secondary country between this narrow ridge, Haverstraw bay, and the Highlands, resembled an extensive plain in a high state of cultivation. The position of towns, and lakes, and the course of streams, were distinctly marked on this map of nature. To the north, the Hudson contracted, appeared far below, like a canal in a deep ravine. Its course for several miles could be traced. Elevated mountains limit the prospect to the north-west. To the south-west the waving Highlands were seen extending as far as vision could reach. The greenstone ranges of the interior of New-Jersey, and the mountains of Staten Island, were scarcely distinguishable from clouds.

The continuity of the Highlands is interrupted in several places, by rivers, and clove passages. The sections to the south, have the local names of Peekskill, Dunderberg, Ramapaugh, Pompton, Stony brook, Rockaway, and Morristown mountains, other ridges situated in the north-western part and centre, are called Sterling, Longpond, Raffenberg, Greenpond and Copperas mountains. Farther to the South are observed, Schooley's mountain, and Musconnitunk ridge. In passing through New-Jersey the mountains expand, occupying a greater breadth, but are less elevated than in the region adjacent to the Hudson, where Newbeacon on the east side rises to the height of 1,585 feet above the river, Butter hill 1,529, Crowsnest 1,418, and Bare Mountain 1,350.

The Highland ranges are primitive, with the exception of an insulated transition region of considerable extent situated in New-Jersey.

The ridges and heights almost uniformly display on their surface, masses of rock that will ever render them of little service to man for cultivation, and continue the principal part of this chain in a state of nature.

Except the narrow district of Smith's clove, no valley of any extent is presented in the western Highlands before they pass into the state of New-York, when fertile and in some places wide intervals commence. The most extensive, situated in the middle region of the mountains, passes through the transition district, and may be traced with an almost unbroken continuity to the Delaware, running parallel with the mountains.

Minerals.

The Highland ridges bordering West-Chester and Rockland counties in the State of New-York, and the secondary region of New-Jersey, present rocks of pretty uniform character—they are in general coarse, well crystalized aggregates of quartz and feldspar, often embracing shorl, garnets, hornblend, and epidote, with little mica, and in many parts for a considerable extent none—these simple minerals variously combined and arranged, form granite, gneiss, and sienite. In the middle or interior ranges situated in New-York, granite often containing black mica is the predominant rock.

Gneiss was sometimes observed, but splitting badly is seldom quarried. Sienite is often seen in every part of the Highlands, and I have noticed in several instances in these mountains well characterized primitive greenstone.

In the transition section of the Highlands of New-Jersey, graywacke and graywacke slate are the most common rocks. The extensive ranges in Bergen and Morris counties, or Long pond, Raffenberg, and Green pond mountains, for miles, present stupendous mural precipices facing the east of a reddish brown graywacke, composed of red and white quartz, red and gray jasper and indurated clay, embraced in a base which has a slight argillaceous odour, but generally composed of fine grains of the above mentioned minerals. These rocks are stratified, inclining to the north-west at an angle of about forty degrees. They are scattered in abundance on the banks of the rapid Pequanack, from Newfoundland to Pompton. Graywacke in place is sometimes observed resting on sienite adjacent to the river Pequanack. The general course of the transition mountains, is from north-east to south-west; and the average width of the transition district, located between the primitive ranges is six miles, and the length between thirty and forty.

Sulphate of barytes, and phosphate of lime are found at Anthony's nose, a mountain situated on the east side of the Hudson. Calc spar and asbestos are frequently seen. There are several extensive beds of iron ore in the Highlands of New-York and New-Jersey. This ore is the magnetic oxide, and is frequently granular. The most considerable of these mines is worked four miles west of the Hudson, in the Pompton mountains, near Rockaway, and at Succasunna. The inexhaustible beds of ore at this last mentioned place, the property of Governour Dickinson, produce the best iron manufactured from Highland ore—native magnet is found near Ramapaugh works, at Succasunna, and at Schooley's mountain.

Sulphuret of iron abounds in various parts of the Highlands. The most extensive bed I have observed is situated in Morris County, near the eastern base of copperas mountain, and nearly opposite to Greenpond. Copperas was manufactured at this place during the last war with Great-Britain by the following process. A minute division was made of the ore by grinding in a trough mill. It was

then spread upon a well-jointed inclined platform of wood, and exposed to the action of air, sun, and moisture—the sulphuret was changed to a sulphate of iron or copperas, by receiving additional oxigen, and the salt conveyed in solution to boilers by passing water over the bed.

Many rich beds of iron ore situated in the Highlands, are rendered useless for the forge by sulphur. It is said this might be remedied by roasting with a moderate heat, pulverising, and then placing the ore in water for some months. Graphite, or black lead, both foliated and compact is found at Mount Dunderberg, and is observed at various places, adjacent to the turnpike which crosses the mountains from Colvill's landing to Smith's clove, and epidote, talc, and adularia in the same neighbourhood.

At Munro iron works, situated upon the river Ramapaugh large plates of black mica crystallized in hexaedral form are seen, sometimes a foot in diameter—compact feldspar and epidote are noticed in the elevated primitive Highland ranges, west of the transition district—gray compact limestone is observed at Smith's clove, and at various parts of the New-Jersey transition interval. In the primitive range, situated in Morris County, west of Pompton plains called Stonybrook mountains, chlorite slate is common—granular limestone has recently been found in the same mountains. Its colour is a clear white, and it admits of a good polish. It is close grained and a nearly pure carbonate of lime, approaching the character of statuary marble. These beds may be regarded as a continuation of the range of granular limestone which accompanies with few interruptions the siliceous primitive from Canada to Virginia. From Stonybrook mountains I have specimens of noble serpentine of a bright green colour, admitting of a good polish. It is often associated with beautiful amianthus and talc, alternating in narrow veins. In the same vicinity is found a grayish white marble, rendered porphyritic by embracing numerous grains of noble serpentine, pretty equally disseminating through the rock. It is hard, and admits of a good polish. In the talc were observed metallic crystals, supposed to be chromate of iron. From this last mentioned mineral is extracted an acid which united with lead, forms patent yellow, or chromate of lead, a valuable pigment. Maryland is the only locality for chromate of iron in useful quantity hitherto

found. Galena has been seen in the graywacke ranges adjacent to Greenpond. Beautiful tremolite is connected with the white granular limestone of Stonybrook. The red oxide of zinc is abundant in the Highlands of Morris County within a few miles of Sparta, it is associated with granular iron ore. It is likewise found in several iron mines situated in Sussex County. As pure zinc can easily be extracted from the red oxide ore so plentifully observed, it is a matter of surprise that no attempts have been made to furnish that very useful metal to the public from the New-Jersey mines. Sulphuret of zinc is found near Hamburg and Sparta—crystals of quartz are frequently noticed in the rocks of the interior Highland ranges.

To the north-west the Highlands are bordered for their whole extent by a transition region which presents graywack slate, and blue compact limestone to the vicinity of New-Jersey.

In the transition of that state west of the Highlands, crystalized aluminated, white limestone abounds. It ranges through Sussex and a part of Orange County, embracing graphite, talc, zircon, and brucite. A rock in the vicinity of Sparta was formerly the only known locality for the last mentioned mineral. I have recently found it half a mile from that spot and Col. Gibbs has discovered it in quantity several miles distant. Dr. Torrey has observed it in specimens of white limestone from Orange County, and has recently been informed in a communication from Sweden, that a mineral of that kingdom is considered by Professor Berzelius the same as the brucite and called chondrodit, regarding it as a new species. The colour of brucite is a bright yellow, with a resinous lustre, found in crystals seldom perfect, and in amorphous masses three inches in diameter. In the limestone embracing this mineral, mica and foliated graphite are observed. I found at Sparta, masses of this last mineral, of several pounds weight. Compact gray limestone is seen in many places between Hamburgh and Sparta near the base of the mountains resting on primitive rock. I noticed in this neighbourhood, petrifications of orthocerites, pectinites, madrepores and other marine, organic remains, generally in an argillaceous base. The most western ridge of the Highlands rises to a greater height than the other ranges of New-Jersey. An interesting view is

presented from its summit, of a rich, well-cultivated limestone valley fourteen miles in width situated in Orange and Sussex Counties. The soil is well adapted for wheat, which is abundantly raised. Beyond this interval the Shuongunck mountain is seen in connection with the blue ridge ranging the western horizon for fifty miles.

Animals.

The wild beasts of the forest, though not so numerous as formerly, are found in most parts of the Highlands. Wolves at times have been very troublesome to the farmers of New-York and New-Jersey. The wolves of America are less ferocious than those of Europe. Travelling in the Pyrennees, Alps, and Appenines, is often rendered dangerous by these animals. The wolves of our country are put to flight by the presence of man. When taken in a pit or trap, they become submissive attempting no defence. Bears are more common than wolves in the Highlands and mountainous regions of this country. Excepting when they have cubs or are wounded, they have rarely been known to attack the human race. They are very tenacious of life. Bears subsist principally on vegetable food. The lynx and wild cat are common in the Highland forests. Deer are frequently seen in the New-York section of the Highlands, but are far more numerous in New-Jersey. Foxes, rabbits, raccoons, and opossums are plenty, otters are often killed in the mountain waters. The wild cat is a powerful, active, and destructive animal, fearlessly invading settlements, carrying away the lesser domestic animals.

The poisonous reptiles most common are the rattlesnake and copperhead. Rattlesnakes are numerous in the transition mountains of New-Jersey. They find convenient dens in the masses of graywacke at the base of the mural precipices. A farmer residing in Newfoundland valley in the vicinity of Mount Raffenberg, informed me that he seldom killed near his house, fewer than twenty rattlesnakes in a season. Rattlesnakes if unmolested, rarely attack a passing traveller. The copperhead is more spiteful, and its bite equally dangerous. The poison of snakes taken internally, is harmless. Venomous serpents are known by their fangs or sickle-shaped hollow teeth, through which a deadly fluid

is ejected. Neither length of time, nor boiling will divest an extracted fang of its venom. The poison of snakes is more active and dangerous in warm, than in cold climates. The flesh of the rattlesnake is regarded in some parts of our country by epicures as a delicious dish. It has been asserted by respectable naturalists, that rattlesnakes and copperheads are the only venomous serpents of the northern states, and that our impression of the poisonous character of the adder and viper is derived from a misnomer of American snakes—but I have the most authentic testimony of the deadly effects of the bite of Highland adders. That they have fangs has been observed by well informed zoollogists.

Vegetable productions.

The Highland ridges are mostly in a state of nature. To the east of the Hudson between the Fishkill and next Highland range, a considerable district of cleared and cultivated land appears. Adjacent to Hudson's bank almost every accessible part has been stripped of its heavy timber, but situations more remote exhibit thick forests of large trees on the rock bound surface.

Oak, walnut, beach, birch, ash, elm, sugar maple, is the predominant timber. Pine, hemlock and cedar is scattered through the forest adjacent to lakes and streams—on the high points of ground, walnut and oak, are the most common trees. Shrub oak is frequently seen in the transition Highland district which passes through Morris's County. It occupies almost exclusively an extensive level interval situated in the north part of Succasunna plain, it attains the height of six or eight feet, forming an entangled thicket. The ground below is covered by numerous loose stones. I travelled a considerable distance in narrow avenues cut through this diminutive wood.

Lakes and rivers.

In the State of New-York, west of the Hudson, the Highlands present several lakes from four to six miles in circumference, but the largest are observed in the centre or transition part of the range which passes through New-Jer-

sey. The most northern, called Long pond, situated on the confines of the State of New-York, is about sixteen miles in circumference. Moccapin pond occupies a less extent, but greater elevation of ground, and is supposed to be six hundred feet above the waters of an adjacent mountain valley. Green pond, situated to the south of the Hamburgh turnpike and near the valley of Newfoundland, is a beautiful sheet of water about eight miles in circumference. It is bounded on the east by the wood-clad copperas mountain—to the west, forest-crowned, elevated mineral precipices of graywacke, frown over its waters. Two or three farm houses are pleasantly situated on its northern bank, where a fine sand beach is presented. This lake being well stored with fish, is a favourite place of resort for the fishermen of Morris and Bergen Counties. Several of the lakes formed in the transition region present on their borders, extensive and lofty walls of graywacke, and equal in romantic scenery, the celebrated waters of Cumberland and Westmoreland.

Numerous streams originating in mountain lakes, break through the ridges, wind rapidly down the Highland glens, and become auxiliary to the Passaic. The first and most considerable of these streams west of the Hudson, is the Ramapaugh. It takes its rise in the Highlands not far from the Hudson, passes the Munro and Ramapaugh iron works, and joins Pompton river, after ranging many miles, dividing the primitive from the secondary of Bergen County. The next is Long pond river, having its origin in the lake of that name. It connects itself with Pompton river. Farther south is the rapid Pequanack, which after coursing thirty miles in the mountains, enters Pompton plain, and uniting its waters with Long pond and Ramapaugh rivers, forms the Pompton. The Hamburg turnpike for sixteen miles, runs near the Pequanack, and presents much romantic scenery.

The river Rockaway has its source in Green pond lake, and joins the Passaic in the alluvial valley above the little falls. These streams present numerous mill-seats, many of them occupied by manufactories of iron. Except in the vicinity of turnpikes, at small manufacturing villages, and in a few mountain valleys, the Highlands exhibit a thinly scattered, ignorant and indolent population. In many parts but little removed from a state of nature, subsisting by a little farming, hunting, fishing, and the sale of lumber.

ART VI.—*On certain Rocks supposed to move without any apparent cause.*

REMARKS.

We have hesitated as to the admission of this piece, because *a name* may always be reasonably required when extraordinary things are related. On enquiry however, we find that the belief stated to exist by our anonymous correspondent, is actually entertained in the vicinity, and therefore we have concluded to let the thing take its chance with the public, without in any way committing ourselves as to the truth of the opinion entertained.—*Editor.*

TO PROFESSOR SILLIMAN.

WILLIAMSTOWN, Feb. 10, 1822.

Sir,

As I was lately travelling through the State of Connecticut, my attention was excited by a curious, and to me a novel phenomenon. In passing through the town of Salisbury, I was informed that in a certain pond, in the north-east part of the town, there were a number of rocks continually, though gradually, moving towards the shore. At first I concluded that this was like one of those stories of the marvellous, which are circulated in almost every place, and springing from some unknown source, gain some addition from every narrator, till at length they become "strange—passing strange."

I was not unacquainted with the dancing bogs and falling mountains of Hibernia, but never before had I heard of rocks, on level ground, taking up a gradual line of march, and overcoming every obstacle in the sublime effort of escaping the dominion of Neptune. Perhaps there are numerous cases like this—if so, they have not as yet come under my observation. Determined to learn the truth, I visited the place, accompanied by a gentleman who resides in the vicinity.

Included you will find a sketch* of the situation of the lakes, road, &c.; and though in some small particulars

*See the plate at the end of this No.

it may be deficient or inaccurate, yet as a whole it will give you a tolerably correct idea of their relative position. C, the road; F, canal uniting the ponds; B, a low marshy swamp; D, an orchard on higher ground; A, moving rocks. From careful observation I am convinced that the lakes were formerly one. The low ground marked B is evidently alluvial. It lies almost on a level with the surface of the water, and shells are invariably found in digging a few inches. The soil is a black mould, covered with willows, and a growth of ash of forty years standing. Indeed, the proof is so satisfactory, that this was once covered with water, that any one, who visits the spot, cannot doubt for a moment. The next thing which I would notice, is the narrow isthmus, through which the road passes, leading from the east to the west part of the town. The road itself is a natural elevation of some feet above the adjacent low ground, of convenient width, and formed of limestone rocks, evidently not in place, and apparently thrown carelessly together. To the question, how this extensive elevation was formed, I can give but one answer. From some cause unknown, they have moved from the lake and taken this position. My reasons for this conclusion are the following:— First, all the stones in that part of the lake, adjacent, are constantly moving in that direction. Second, no similar collection of detached rocks can be found, except in the vicinity of higher ledges, or such as are artificial. This is a highly primitive country, and much abounding in carbonate of lime. The strata of limestone, which extend from Vermont through Berkshire, to Connecticut, and afford such excellent marble, run through this town, and stretch towards the Atlantic. This, it is well known, is always found in quarries of considerable extent, and never scattered over the surface of the earth, except in the cases above mentioned, or in the vicinity of rivers. Where there are lofty ridges of it, exposed to the action of the elements for a series of ages, we naturally expect to find detached masses* scattered round. But here the country adjacent is level, and, within the com-

*I fear there are many facts which cannot be accounted for by any of the existing theories. Of the two popular theories, how can the fact that some of the densest and heaviest of the minerals lie near the surface, be made consistent with the one, or the order observable in the position of the different strata with the other?

pass of nearly a mile, no such eminences appear. But I shall perhaps throw some light upon this, when I come to those rocks which move. The third argument which might be adduced, is the situation of the rocks. This neck of land (I mean that part of it which is not alluvial,) is nearly of the same width throughout. Were not some of the rocks of which it is composed, of such a size, we should undoubtedly be led to suppose it an artificial causeway. Does not this equality, or uniformity of width, favor my supposition?

As to the moving rocks, I made such observations as my short stay in the place would permit. This phenomenon was known to the first inhabitants of the town. Its probability was suggested by their own observation, and its truth established by actual measurements. From the gentleman with whom I visited the spot, I obtained the following measurement. Its correctness may be implicitly relied on.

Sept. 1819. The distance from the largest rock to a certain birch tree on the shore, was 15 rods 39 links.

Feb. 13, 1821. The distance of the same rock to the same tree, was 12 rods 37½ links. Subtracting 12—37 from 15—39, leaves 3 rods 2 links, which this rock moved in less than eighteen months. The same gentleman measured it each time, and used the same chain in both.

Twelve* years ago it moved but five feet in a year. Its motion is therefore accelerated as it approaches the shore. I have spoken particularly of this rock, because it is the only one whose exact progress has been ascertained. All the stones however, in this part of the lake, move, from the largest to the smallest, and leave a track or trench behind them, of greater or less magnitude, in proportion to the size of the stone. The largest rock (and it probably weighs forty or fifty tons,) has ploughed up the sand and gravel before it

*The island marked E is about three quarters of a mile from the shore. It is composed of mica slate, lying on a bed of limestone; large masses of the latter lie on the shore of the island. You will see by a simple calculation, that, at the present rate of moving, they will reach the opposite shore in less than a hundred years. That those masses composing the foundation of the road came from thence, I will not pretend to say.

The minerals I observed in Salisbury are the following:—Tremolite radiated, stellated with fibres nearly two feet long; Garnets in abundance; Staurotide; black and white Mica; Jasper; Sulphat of Iron; Alumine; Iron ore—all varieties; generally the brown Iron stone of Werner; Dolomite; Carbonate of Lime; Mica slate; Clay; Ochres, &c. of various kinds. Some Copper, in the Iron-ore lately found.

nearly above the surface, while on the other side the water is three or four feet deep.

Forty years ago, I am informed, this rock was entirely covered with water; now it projects some feet. Several other facts could be adduced to prove the motion of these rocks, but I consider it unnecessary. Universal belief of a phenomenon so uncommon, is of itself sufficient in my mind to establish it.

Respecting the causes of this phenomenon, none, which are at all satisfactory, have as yet been suggested. Some pretend that it is effected by the agency of ice. We very well know the great expansive power of ice; but how it can move some rocks, and not others, and even some which it does not touch, we are yet to be informed. Accurate observations, to find in what part of the year they move most, would probably afford some assistance to the enquirer. That such observations be made, is highly important, and earnestly desired.

Such, sir, are the results of my investigation. Should you esteem them worthy a place in your Journal, they are at your disposal. Yours, &c.

PETROS.

A FRAGMENT—PUTNAM'S ROCK.

Extract of a letter from Prof. Dana of Dartmouth College, to the editor, dated Feb. 5, 1822.

I HAVE received an account of "*Putnam's Rock*," which is in the river opposite West-Point. It was given to me by my friend Col. Tucker, of Gloucester, Mass. and the history, as connected with the American Revolution, cannot fail to be interesting; I will give it in the Colonel's own words, as there is a naïveté in his manner of relating it.

"This famous rock, originally a native of the highlands above West-Point, was situated on the extreme height of *Butter-Hill*;‡ when the morning fog was descending from the hill, it had a very beautiful appearance, not much unlike a horseman's tent or hospital marquee riding on the cloud. It was a common amusement for the officers when off duty

‡This hill is 1520 feet above tide water, and 1332 above its base, according to Capt. Partridge.—*J. F. D.*

to roll large rocks from the sides of those hills. These often set others going with them, to the great terror of those persons who were below. One day when this laborious amusement was over, Col. Rufus Putnam (in whose regiment I served as Lieutenant,) proposed going up to take a peep of this curiously situated rock; it was found situated on a flat rock of great extent, and near the brink of a considerable precipice, and hung very much over it. Col. P. believed that it was moveable, and if once moved would roll over; and, falling from 20 to 50 feet, commence its route to the river. A few days after we formed a party of officers, with our servants, who took with them axes, drag-ropes, &c. in order to procure levers for the purpose of moving the rock, which we soon found was in our power. The levers being fixed with ropes to the ends of them all, Col. Putnam, who headed the party, ordered us to haul the ropes tight, and at the word *Congress* to give a long pull, a strong pull, and a pull altogether. This we did; the levers fell, the rock rolled over, tumbled from the precipice, and took up its line of march for the river!! The party then had the satisfaction of seeing the most majestic oaks and loftiest pines bowing down in homage and obedience to this mighty traveller, which never stopped till it reached the bed of the river, where it now lies on the edge of the flats, and far enough from the shore for a coasting vessel to sail around it. The party followed after in its path, and were astonished to see that rocks of many tons weight, and trees of the largest size, were ground to powder; on arriving at the river the party embarked, and landed to the number of sixty or seventy on the rock, where Col. Putnam broke a bottle of whiskey, and named it "*Putnam's Rock.*" I may have forgotten some of the minutiæ of the transaction in the lapse of forty-three years, but it is a fact that the rock now in the river was removed from the extreme top of Butter-Hill, by the officers of Col. Rufus Putnam's regiment, in the Revolutionary war, in the service of the United States, sometime in the month of June, in the year 1778."

Art. VII.—*Miscellaneous notices in Mineralogy, and Geology.*—Editor.

1. *Snowy Gypsum* in extremely delicate crystaline scales, so minute as to be scarcely discernible by the naked eye—colour pure white, with here and there a slight tinge of grey; it might be wrought as an alabaster, and is more beautiful than any thing which we have seen, that was produced in this country. We received it from the Hon. John Calhoun, Secretary of War, to whom it was forwarded by Mr. Horton Howard, who writes from Delaware, Ohio, that it is found in a large body on the shore of the north side of Sandusky Bay. Mr. H. R. Fenn of Rochester, N. Y. has handed us a similar specimen from Rochester, L. Ontario, where it is found imbedded in fetid limestone.

2. *Nephrite*, so called by Dr. Mead. This beautiful mineral is of a lively apple green, like chrysoprase—it is almost impossible to break it, such is its excessive tenacity—its fracture is splintery—it is softer than the nephrite of the books, being scratched by steel. It occurs in large masses imbedded in white primitive lime-stone, which is almost compact—this mineral has not been analyzed and perhaps it may be doubted whether it is the genuine nephrite—we understand it is nearly exhausted—locality Smithfield near Providence—the specimens were from Mr. George T. Bowen of Providence.

3. *Compact magnetic oxid of Iron*, lustre highly resinous—colour brown—Owyhee, from the American missionaries in that Island.

4. *A vesicular lava*, like that of Hecla. It forms a prevailing rock in Owyhee.—Id.

5. *White statuary Marble*, North-West Coast of N. America.—Id.

6. *Native Copper* in rounded pieces—near the mouth of St. Peters river which empties into the Mississippi—this native copper is frequently covered with a coating of green oxid and is disseminated among limestone rocks. Rev. Dr. Morse and son.

7. *Carnelians and agates*, very well characterized.—Alluvial banks of the Missisippi, at Prairie du Chien—Id.

8. *Quartz*, perfectly milk white–Sandusky bay, Ohio.–Id.

9. *Reddle*—a very fine quality. Indian Pipes made of this substance—Banks of lake Superiour.—Id.

10. *Sulphate of Strontian* in distinct tabular crystals of a light sky blue colour, three fourths of an inch in the largest diameter, lining a cavity in grey compact limestone which is its native bed—Gross Island, mouth of Detroit river.—Id.

11. *Fibrous Gypsum*—-Martin Isles—four miles from Mackinaw, the vein is too inches thick and tolerably handsome.—Id.

12. *Red Ochreous earth*—Michigan territory.—Id.

13. *Galena*, a most beautiful specimen of the broad foliated variety, exactly like that of the Missouri mines—seven miles below the Ousconsin, on the east bank of the Mississippi. The mines belong to the Sacs and Foxes, who are said to be very jealous of their rights.—Id.

14. *Gypsum*, superb specimen folia broad and curved—Manlius, Onondago county, N. York, south bank of the great canal.—Id.

15. *Staurotide*, imbedded in mica slate—Alstead New-Hampshire—Mr. J. D. Bradley.

16. *Serpentine*, leek green with magnetic Iron imbedded—Cavendish, Vt.—Id.

17. *Asbestos*—very delicate—Mount Holly, Vermont.—Id.

18. *Macle* or *Chyasolite.*—-This mineral occurs in Charleston—Cornish—Croydon—Alstead and Langdon, N. Hampshire—Bellows-falls and Westminster, Vermont.—Id.

Very dark grey Cyanite—Charleston, New-Hampshire, no greenish or bluish tinge.—Id.

19. *Mica* in large plates—Alstead, New-Hampshire.—Id.

20. *Green foliated Talc*, containing Actynolite On page 54, Vol. 4, of this Journal mention was made of these minerals as occuring in Windham Vt. Since that notice was written, we have received very superb specimens equal to any from the best European localities. The largest crystals of Actynolite are half an inch in diameter, several inches long and of a rich green colour.—Id.

21. *Sulphat of Barytes* in limpid tabular crystals, occupying cavities in sand-stone—along with quartz crystals, malachite, common sulphat of Barytes, &c.—-Cheshire, Connecticut.

22. *Ferruginous sand-stone*—it is a quartz in grains, cemented by brown oxid of iron of a resinous appearance—it is said to be a good material for a sub-marine cement. Virginia.—D. M. Randolph, Esq.

23. *Sand-stones* with organized remains.—Id.

24. *Lime-stone* with very large and distinct screw stones, as they are commonly called.—Id.

25. *Rutilite,* three miles from Philadelphia, Mr. Lea.

26. *Prim. white, carb. of lime,* twelve miles from do.—Id.

27. *Sulphat of Barytes* stained by carb. of copper, forty miles north of do.—Id.

28. *Granite* with handsome garnets, Wilmington, Delaware.—Id.

29. *Zeolite* three miles from Philadelphia.—Id.

30. *Sappar,* near do.—Id. Pistazite do.—Id.

31. *Sulphuret of Molybdena,* fifteen miles south of Philadelphia.—Id.

32. *Sulphat of Barytes* crystallized in tables.—Southington, Connecticut.

33. *Yellow blende*—galena and crystallized carbonate of lime, do.

34. *Quartz Geodes*—Berlin, Connecticut, in green-stone trap.

35. *Octahedral Iron,* large and distinct crystals—believed from Bridgeport, Conn.

36. *Galena Foliated*--very handsome—Livingston's mine N. Y.

37. *Novaculite*—the middle specimens good—the extreme verging towards mica slate--Island in Lake Memphremagog.—S. S. Conant, Troy.

38. *Iron ore*--fine grained, micaceous--very beautiful—Jamaica twenty miles west of Bellows-Falls—Dr. Allen.

39. *Staurotide*—crystals crossing at right angles—Southbury.

40. *Adularia*--nearly equal to that of the Alps—Brimfield, Mass.--Professor Eaton.

41. *Bitterspath,* beautifully crystalized with common crystallized calcareous spar and snowy gypsum, fibrous and foliated.—Shores of Lake Ontario.—Dr. Lyman Foot.

42. *Shot Ore,* Franklin near Sparta, New-Jersey. This ore is so called by the boys because they use it as a substitute for shot in firing at birds. It is found in company with

the red oxide of zinc. It was analyzed in France by Berthier and found to consist of iron manganese and zinc. (See Vol. 2, p. 323 of this journal.)—Dr. Meade.

43. *Yellow blende*, very beautiful accompanying foliated carbonate of lime these substances reciprocally intermix with each otber and form an elegant combination. It accompanies the *shot ore* mentioned above and the red oxide of zinc. Sparta, New-Jersey—Id.

44. *Vegetable Impressions* of ferns and other plants remarkably distinct in transition slate, Providence, R. Island—Mr. Geo. T. Bowen.

Art. VIII.—*Notice of the locality of Sulphate of Barytes, from which a specimen was analysed by Mr.* G. T. Bowen; *(See p. 325 Vol. IV. of this Journal,) and of various other mineral localities in Berlin* Conn.*; by Dr.* Jas. G. Percival.

TO PROFESSOR SILLIMAN.

Sir,

The specimens of Sulphate of Barytes analysed by Mr. G. T. Bowen were found in Berlin, about half a mile west of Kensington meeting-house, in a vein in a ridge of green stone. The immediate vicinity furnishes several very interesting minerals. The township is part of the red sand-stone formation extending from New-Haven through Connecticut and Massachusetts to Northfield. The rock is there schistose, generally soft and argillaceous; sometimes the folia are very thin and brittle. This rock in many places is overlaid by green-stone. On the west and south sides of the town is a range of trap mountains; the sand-stone rock, where it first comes out from below the trap in Southington and Cheshire, is changed, and approaches to conglomerate. I do not recollect an instance of that form of sand-stone in Berlin; in three points in B. (see the map,) the schist is converted into shale more or less bituminous. The green-stone lies in ridges rather narrow, running quite directly north by east. Sometimes the sand-stone can be very distinctly seen cropping out below the green-stone on the west side of the ridg-

es. In other ridges I have not found any sand-stone below the green-stone, which there seems sunk, as if in a trench, below the general level. I have designed this article as a brief notice of the locality of the Sulphate of Barytes; I shall therefore dismiss more general observations. The sulphate is found in a vein, perhaps two or three feet wide, in a ridge of green-stone. I have subjoined a rude outline of the vicinity. The ridge of green-stone in which this vein is situated, sinks on its eastern side below the general level, and is fronted by a wall of sand-stone at the distance of three or four rods. It contains three interesting localities. (A) the Barytes vein; (C) the coal-mine, and (D) the leadmine —(A) the vein of Barytes. This is in the bed of a brook, where it passes in a deep ravine through the green-stone ridge, directly below a mill-dam. The ravine is divided by two masses of rock, so that there are three dams. The north turns a grist-mill; the middle an oil-mill; and the south a saw-mill. At the bottom of the ravine the three channels unite, and pass under two bridges almost contiguous. The vein appears first in the bed of the south channel, just below the saw-mill; it is there traceable north by east about a rod. It is again discoverable about four rods north, in the bed of the stream below the upper bridge. Both of these points are on the same line. The vein is two or three feet wide; its surface is iron brown, and tarnished; but on breaking it, it appears of an opake pearly white. It is foliated, and breaks into rhomboidal fragments; it is very brittle, which renders it very difficult to detach it in large masses; it often assumes on its surface the appearance of coxcomb spar. I have found fragments of it in the brook below, imbedding crystals of Galena. Parallel with it, and separated by a narrow partition of green-stone, is a thin vein of carbonate of lime foliated, and transparent in fragments. The hyaline appearance of the carbonate easily distinguishes it from the pearly hue of the sulphate. The eastern wall of the ravine projects over, and forms a recess near the upper point of the vein; the ceiling of this recess is covered with minute effervescing stalactites. Directly south of the vein the green-stone rock has been torn away, and its fragments are full of geodes of quartz crystals, often taking the form of hollow cylinders lined with crystals. A little farther south is a large rolled rock

of granite; on the surface, (C) the coal-mine. This has been opened on either side of the brook, where it passes through a narrow ridge of green-stone. The coal has been found only in the green-stone. Directly fronting this rock, on the east, is a wall of sand-stone slate, at the base of which the brook runs. The coal was first found, and wrought, in the bed of the brook, about twenty years ago; about six years ago, a company in New-York made new openings in either bank of the brook. The coal is found in veins in connection with crystallized quartz; the quartz often appears in geodes whose cavities are filled with coal; narrow veins have their walls lined with crystallized plates of quartz, and are filled with coal; the coal has never been found in large masses: the largest that I have seen not more than two or three pounds. The larger masses are foliated, shining, brittle, and very bituminous; but it more usually has the appearance of cinders so mixed up with silicious matter as to be hardly combustible. The sand-stone in its vicinity I have not observed to be converted into shale. On the eastern face of the green-stone ridge, forty rods north of (C), on the west bank of the brook, is (D) the lead-mine. This was first opened during the revolutionary war, and again about fifteen years ago. Several of the old pits and heaps of rubbish remain; the veins are found in a north by east direction; the minerals I have found in the rubbish are galena, in small cubical crystals, foliated, and finely granular; the crystals which are exposed to the air are often covered with a thin pulverulent coat, or they are beautifully iridescent. Blende yellow and black, the latter rare; it is in much larger masses than the galena. Pyrites; this is the rarest of the three sulphurets; the gangue is sulphate of barytes, resembling that of the former vein—often resembling coxcomb spar. Carbonate of lime; colourless and crystallized, or foliated; agatized, i. e. in layers of different colours and textures, foliated, granular, and fibrous. The fibrous layers are generally external, thin, with the fibres perpendicular to the direction of the layers. Quartz in geodes and crystallized plates, (a fine-grained green mineral, resembling disintegrated green-stone?*) On the eastern face of the green-stone ridge, between (C) and (D,) the rock is

* Chlorite?—this is found in similar circumstances in the green-stone near New-Haven.—*Ed.*

speckled with minute cavities, occupied by chalcedonies, agates, and quartz crystals. The valley of the brook is there filled with pebbles, in which I have found blue and white agates, and abundance of quartz crystals; some nearly perfect, one an inch long, with the prism and two pyramids, and some slightly tinged with amethyst. This valley is bounded easterly by a sand-stone ridge, on the top of which stands the Meeting-house; about half a mile south of the M. house, in the bed of a ravine, is a bed of shale, (F) which gives by friction a strong sulphureous smell. Directly east of this sand-stone ridge, is a ridge of green-stone, based on sand-stone; on its western face, half a mile north of the road, is an interesting display of different sand-stone strata; (G) the upper are not schistose, but compact and soft, more or less tinged with purple; the green-stone in breaking often turns out nodules, which are richly irridescent on their surface. I think them strongly impregnated with iron, and this is communicated to the sand-stone or indurated clay. Beneath these strata is a stratum of free-stone, of excellent quality (real sand-stone;) the rock then becomes more schistose, and the lower strata are in thin layers, and very brittle—breaking into minute fragments. Where the road ascends the east face of this ridge, (E) the green-stone is fragile, breaking into fragments of which the road is formed. The fragments are porous like slag or lava; on penetrating into the rock these cavities are found occupied by zeolites, or lined with minute chlorite crystals. The zeolites are of two varieties; foliated fibrous and radiated; on exposure to air they become opaque white, pulverulent, and are finally dissipated; leaving the rock porous. This, I presume, is owing to the same decomposition which converts the coarse grained granite of veins in gneiss into kaolin, of which I have seen striking examples on the Schuylkill, near Philadelphia. East of this latter ridge is an extensive flat of alluvial formation, where several streams centre from the surrounding hills and mountains. Yours, &c.

JAMES G. PERCIVAL.

ZOOLOGY.

[Communicated for insertion in this Journal.]

Art. IX.—*A group of Polypes, belonging to the family of Comatula, with an extraordinary form and configuration from the Indian Seas.*

[Specimen presented and description read to the New-York, Lyceum of Natural History, at its sitting in the Institution, on Monday, Feb. 25, 1822.]

Gentlemen,

My friend Mr. Covert, on a voyage from Canton to New-York, during 1821, cast anchor with eighteen fathoms of line (one hundred and eight feet) in the straits of Gaspar, situated to the eastward of the island of Banca.

On hauling up the deep-sea-lead, two marine productions which adhered, were brought on board the ship; one attached to the weight below, and the other clinging to the cord about ten feet from the bottom, or above the lead.

Both the specimens were brought home in good condition, and presented to me. Though they seem to be individuals of the same species, it was observed that when they were taken out of water, one of them appeared for a while yellow, and the other blue. This was probably, while the polypes were living, for after death, the colour became a purplish brown, or of the hue belonging to many of the gorgonias.

According to the modern classification, this singular and elegant production, belongs to that tribe of the polypes which makes floating or moveable habitations.

The Comatulas are the most remarkable members of this family. They have a calcarious or corneous axis. They are not located in a spot, or fixed in a particular place, but move or swim about.

The one now presented, instead of a *single feather*, as usual, consists of *ten branches*, proceeding from a common base or centre, and diverging outwards with an easy slope, makes a display like a coronet of plumes. Each is about

eight inches long, and tapers gradually upward. The fringe-like appendage is on the inside, forming a row of offsetts, about half an inch in length. The feathers articulated from the bottom to the top, are composed of parallel circles or rings.

From the receptacle or point, where the receptacle exists, at which all the plumes unite, or from which they issue, a set of arms or feelers proceed or project in an opposite direction. These arms or feelers have some resemblance to the antennœ of lobsters; though from their disposition to clasp the things which come into contact with them, they resemble the tendrils of plants. They are nearly of the size of small crow-quills; and vary from half an inch to an inch in length. They are articulated and coloured like the plumes. They are twenty in number; and the extremity of each is armed with a claw like that of a bird or of a cat. Several of the joints or articulations, near this terminal claw are also armed on the inner side, with claws of a like organization, but of a smaller make. The arms or feelers, undoubtedly possess the power of expansion or groping, and of seizing or embracing any object they may find. In one of the individuals I possess, a five rayed *asterias*, is firmly held, and indissolubly bound, by the embrace of the Comatula.

This production of the Indian ocean, connects the *polypes* and *radiaries* with the *sepias*, and all of them with the *ten-footed crustaceas*,

Truly, and as ever, respectfully yours,

SAMUEL L. MITCHILL,

BOTANY.

Art. X.—*Attempt* of a Monography of the Linnean Genus Viola, comprising all the Species hitherto observed in North-America; by* Lewis D. de Schweinitz, *of Salem,† North-Carolina.*

[Communicated for this Journal.]

PRELIMINARY OBSERVATIONS.

The accession to the Flora of North-America, by the united efforts of the growing number of able Botanists, is becoming such, that a necessity begins to be sensibly felt of reviewing and comparing their labors, in order to avoid that confusion of synonymy, which must otherwise inevitably ensue. It is of great importance, more especially in those genera which comprise numerous species, and the annexed disquisition has for its main object, such a comparative review of one of these. The Genus *Viola*, constituting no contemptible, though no very brilliant contribution towards Flora's vernal wreath among us, evidently labors at present under considerable confusion of its numerous species, and their varieties; which is increased by the uncommon degree of variability apparent, even among the individuals of the same species. An attempt to define and establish these, and to point out such characters for each as may facilitate discrimination, is therefore peculiarly necessary; and my vicinity affording favorable opportunities of observing the greater part in their native places, while my collection contains excellent specimens of almost all the rest, I have bestowed a good deal of attention upon the Genus. I flatter myself, that the results of my study and observations, here communicated, may contribute towards a better discrimination of the American species of Viola, and thus prove acceptable to Botanists.

As far as my means have enabled me, I have endeavored to determine the synonymy of the species hitherto descri-

*Received July 28, 1821. †Now (April 1822,) of Bethlehem, Penn.

bed by authors. But in the execution of this plan, I found myself under the imperious necessity of proposing several new species, as a means of extricating some of those hitherto received, from the attending difficulties. It has been my endeavour not to do so upon slight grounds, but on the contrary to satisfy myself by reiterated observations, in most instances continued for several years, of the constancy of the characters, I have selected. The ample descriptions I have given of all, I had an opportunity of studying, in a fresh state, will enable Botanists to test the accuracy of my discriminations.

The generic description of the genus given by Mr. Nuttall (p. 147, Vol. I.) is so satisfactory, that it is needless to repeat it. His observation concerning the apetalous flowers of all our species, I entirely accord with, although they appear not so regularly in the Caulescent family, as in the first; and it is impossible not to coincide with him as to the anomolous V. *concolor*, which evidently, together perhaps with some tropical species, ought to be generically sèparated from the rest. All the other American species form, with those indigenous to northern Europe, (the greater part of which are in my collection,) a most excellent natural genus. There is however no single European species that can with propriety be considered identical with any of ours, unless it be the V. *bicolor* and even this differs so much, that I cannot think them the same; indeed, it is rather remarkable that no European Viola, except very partially the V. *odorata*, appears to have become naturalized in America, not even the *tricolor*, so extremely common in Europe in fields of grain.

The American species, like those of Europe, form two very handsomely distinguished groups or families; the first altogether *Stemless* (acaules,) and the other *producing stems* (caulescentes.) With us the number of species in each is nearly equal. The first group contains only four European species—the last from 16 to 17; a considerable proportion of which are alpine, and belong to the subdivision, *Stipulis pinnatifidis*, of which we have but one. I presume some more, and perhaps new ones might be found in our highest northern mountains, or in Labrador.

Genus Viola.

Classis V. *Pentandria.* *Ord.* I. *Monogynia.*

A. *Violae acaules ; Stemless Violae.*

Species of Europe, belonging to this family :

1. V. *pinnata*. 2. V. *hirta*. 3. V. *palustris*. 4. V. *odorata*.

1. Species. V. *pedata*. Linn.

Wildenow, Spec. p. 1160, n. 2.
Persoon Synopsis, p. 254, n. 2.
Michaux Fl. p. 151,
Pursch Fl. I. p. 171, n. 1.
Nuttall Gen. p. 147, n. 1.
Elliot p. 300, n. 10.
Walter p. 219.
Muhl. Cat. p. 28. n. 2. by specimens.
New-York Cat. p. 28, n. 2.

Viola digitata Pursch p. 171. belongs to this species; and is the advanced state thereof.

V. acaulis. *Foliis* ime pedato-multipartitis (septempartitis,) glabriusculis, margine saepe ciliatis, aetate provectiori rugosis, venosis. Laciniis lineari-lanceolatis ; in foliis primariis integris aut subdentatis, magisque rotundatis ; in secundariis elongatis, acutioribus, et fere semper tridentatis. *Petiolis* primum brevioribus scapis, demum elongatis, longis, sensim in folia expansis, vel potius foliis in petiolos angusto margine decurrentibus. *Stipulis* radicalibus, albis, membranaceis, basi latis, in longum acumen productis, marginibus dense ciliatis, ciliis longis flexuosis.

Floribus maximis, habitu applanato, coeruleis. Primariis breviter pedunculatis ; secundariis, in scapis longis, folia tamen non excedentibus. *Petalis* nullis barbatis ; inferiori latissimo, superioribus ovatis, omn. rotundatis. *Calycis* laciniis lanceolatis acutis, margine colorato, ciliato, ceterum glabris ; postice productis truncatis. *Stigmate* maximo, compresso, angulato ; apice oblique truncato, perforato ; cum antheris valde prominente.

Scapis angulosis, demum longis, glabris. *Stipulis* binis, ad basin scapi, oppositis, linearibus, adpressis, longis, flexuosis, breviter ciliosis aut integris.

Capsula glabra, stigmate persistente coronata.

Radice crassa perpendiculari, frequenter emittente radiculas longissimas.

This elegant species, seems to be recognized by all Botanists. The only one any way nearly related, is the alpine species of Europe, V. *pinnata* ; the leaves of which are however much more numerously and less deeply divided, and the divisions obtuse. The divisions of ours, are called *septempartite* by authors, and this in fact is the common number, but by no means constant. Mr. Elliot truly observes, that the leaves afford a fine exemplification of a

pedate leaf, especially the early leaves. I am perfectly satisfied, that the V. *digitata* of Pursch, found by Mr. Leconte in Virginia, must be considered identical with *pedata*, having seen innumerable individuals of the latter assume a form as the season advances, altogether answering the description of *digitata;* some indeed, with the first leaves still remaining upon the plant. Later in summer and autumn, I have occasionally met with specimens forming very large tufts, with leaves extremely rugose and veiny, on petioles five or six inches high, expanding into the leaf, and uncommonly large pale blue flowers. The *pedata* begins to flower, with us, end of March, and is very common in dry woods throughout April. I never found it in moist places, and Mr. Elliot observes that it rarely occurs within sixty miles of the seacoast. Northwardly it appears in May. The beautiful variety, mentioned by Pursch, having the two upper petals of a dark purple and velvet appearance, is common here and elsewhere, *β. velutina.* It is more slender in all its parts, and forms but small tufts, often with a single flower and a much longer scape.

2. Spec. V. *palmata.* Linn.

Remarks.—This species, and the next, appear to have been confounded by most Botanists. In fact it is not easy to fix upon proper diagnostic characters between them, without an attentive study, in their different stages of growth. They and others, of this family, put forth leaves of very different shapes, not only at the same time, but successively, so that the same individual plant might readily be mistaken for a different species, when more advanced; especially as they continue to flower, during the whole course of these metamorphoses, ending with apetalous flowers. By close observation of the same individuals, continued to the last stage, I conceive myself able to point out such constant characteristics, as may serve to distinguish each species at all times.

I have to observe generally, with regard to the disposition of the leaves, in all the heterophyllous species of Violae acaules, that the more entire leaves, whether cordate, reniform or lanceolate, are always the outward ones of the tuft, the lobed ones, the interior. The entire ones, are moreover on much shorter petioles. The lobed leaves too, except in *palmata*, where they appear immediately, are generally of later growth and augment in number and vari-

ety of shape, as the plant advances. After inflorescence, the leaves of most of these, and indeed generally, throughout this family, seem to expand and grow very vigorously, often attaining a size and appearance, altogether unusual with them, while in a flowering state.

It cannot be expected, that I should have perfectly succeeded in referring the confused Synonymy to my species, as established below. I have therefore accompanied my citations to *palmata* with remarks, pointing out my ideas more particularly.

Wildenow Spec. p. 1159 n. 1. I conceive, from the expressions used, that this, together with all the citations, ought to be exclusively referred to *palmata*. *Pluk.* expressions are peculiarly appropriate.

Persoon Synops. p. 254. n. 1. may well allude, both to *palmata* and the next.

Michaux p. 151 evidently includes both.

Pursch p. 172. n. 3. Not definite enough to distinguish.

Nuttall p. 147. n. 2. Mr. N.'s observation concerning the resemblance to V. *cucullata* appears to have been occasioned by specimens belonging to the next species, not distinguished by him—otherwise, it is clear that he refers to my *palmata*.

Elliott p. 300. n. 9, exclusive of his variety d) *heterophylla*, is decidedly *palmata*. That variety may belong to a separate species.

Muhl. Cat. p. 25. n. 3. By specimens.

Walter See Elliott.

V. acaulis. Foliis *primariis* raris, cordatis, reniformibusque, plurimis, et *secundariis* omnibus, palmatis, lobis diversissimis, medio lobo semper majori; omnibus crenatis, dentatis, plerumque nervosis; plus minusve pubescentibus; interdum undique cano-pubescentibus, interdum glabriusculis, nervis tamen semper pubescentibus. Statu juniori, foliis perpaucis, demum frequentioribus. Primariis saepe provenientibus in stolone distante a scapo. Lobis foliorum palmatorum polymorphis, praesertim versus basin saepe multifidis, angustis; interdum etiam lyratis, et truncatis. *Petiolis* quasi canaliculatis, ob marginem decurrentem ex folio angustum; interdum glabris, saepe pilosis. *Stipulis* radicalibus magnis, lato lanceolatis, submarcidis et coloratis, margine subciliatis. *Foliis* saepe subtus rubicundis et purpurascentibus.

Floribus majusculis, violascentibus et purpureis, contortis; petalis lateralibus maxime albo-barbatis, ceteris glabris; *inferiori* ovato, postice naviformi, manifestim carinato, antice rotundato, venis purpureis ornato; omnibus fundo albescentibus. *Calycis* laciniis ovato-lanceolatis, glabris, margine albescenti ciliato. *Stigmate* capitato, recurvo, rostrato, marginato, depresso. *Antheris* in fundo reconditis.

Scapis longitudine foliorum, interdum glaberrimis. *Stipulis* minutissimis, oppositis, in medio scapo, aut inferius sitis, linearibus, ciliatis.

Capsulis glabris, calyce brevioribus.

Radice obliqua crassiuscula, caespites pauci-foliosas efformante.

This is by far the most variable species, and consequently the most perplexing. Scarcely two individuals are perfectly alike, and I can hardly figure to myself any possible formation of palmately lobed leaves, which I have not met with. Every different situation, as to shade, soil and perhaps even weather, appears to alter the shape of the leaves, and I think it useless to attempt to reduce these ever varying forms to definite varieties, as they appear multiplied almost without end. The middle lobe is however constantly the largest; in some varieties it assumes a long lanceolate, in others a broad ovate shape, with every possible intermediate one. The lower segments or lobes towards the base again, are always the most diversified. In some they are broadly truncate, in others almost linear and elongate. The degrees of pubescence of leaves and petioles, between an incane villosity and almost smooth, are equally variable. The varieties occurring in rich shaded woodland, are particularly remarkable. One I have repeatedly met with, is exceeding tall and slender, pubescent in the petioles and scape, nearly smooth in the leaves, of which it generally has one cordate, one reniform and one very regularly five lobed. The variety *dilatata* of Elliott might be called the type of the species. A remarkable circumstance is, that the earliest flowering specimens, appearing in March, always put forth one apparently naked flowering scape, with a single undeveloped leaf close to it, and another proceeding from a horizontal radicle or stolo at some distance from the flower. The best general characteristic to distinguish this, at first blush, from the next, appears to me to be this,

that in all varieties and at all times there are but few and scattered entire leaves, and the great majority palmately lobed in some shape or other; while the contrary is the case in the next. Besides this never forms *dense* tufts, and frequently no tufts at all. It is only high in an advanced state—in early spring it is very low. It is in flower here from March to May. After inflorescence, the leaves generally grow to a considerable size. No variety of this species, that has fallen under my observation, is found in swamps or bogs. With this exception, they occur in great quantities almost every where.

3. Species. V. *asarifolia.* Pursch in Suppl.

Pursch Suppl. p. 732. Herb. Sherardi.

Elliott p. 299. n. 7. Mr. E. does not appear to have observed it.

Muhl. Cat. first ed. p. 26. n. 10 *variegata* Donn. by Specimens.

Nuttall among his *palmata*, as appears from his remark, that it is in certain cases distinguishable from V. *cucullata*, only by the constancy of the pubescence; which applies to this species exclusively, as all varieties of *palmata*, at all times, are provided with palmately lobed leaves. Some of Mr. Elliott's observations on *palmata* seem to indicate, that he had specimens of *asarifolia* among his. The *asarifolia* of Muhlenberg's catalogue, is a very different plant of the caulescent family, as Mr. Elliott observes correctly.

V. acaulis. Foliis *primariis* caespitosissimis, omnibus cucullatis, lato-cordatis, interdum reniformibus, magnis; *secundariis* ejusmodi, sed intermixtis raris sagitatis et subpalmatis, lobatis; omnibus crenato-dentatis. Pagina superiori plerumque glabriusculis nervosis, saepe purpureo tinctis. Inferiori pagina, praesertim in junioribus plerumque pilosis, interdum autem tantum in nervis. *Petiolis* crassis, validis, semiteretibus, demum longissimis (ad 10 unc.) semper pilis longis densis tectis. *Stipulis* radicalibus longis, lanceolatis, acuminatis, membranaceis, ad basin petiolorum, saepe trifidis, glabris sed ciliatis. *Folia* quasi flabellatim in petiolos attenuata.

Floribus mediocribus, frequentioribus, contortis in scapis foliis brevioribus purpureis et saepe demum albo-variegatis. *Petalis* magnis plano-reflexis. *Inferiori*, limbo acuminato, saepe bi vel trifido, naviformi, carinato, fundo albescenti,

purpureo-striato; in cavitate pistillacea, barba rara alba obsito. Binis *lateralibus*, intus ex albidis, striatis, barba rigida alba parte superiori adnata. Binis superioribus, nec striatis nec barbatis. *Calycis* laciniis ovato-lanceolatis, glabris, venosis, brevioribus, margine ciliatis. *Stigmate* clavato-capitato, recurvo, nec depresso, nec marginato.

Scapis filiformibus, foliis brevioribus, glabriusculis aut pilis raris. *Stipulis* binis alternis minutis lanceolatis, infra medium sitis.

Capsulis glabris, minoribus.

Radice crassissima, corrallina, obliqua, emittente fibros longos et caespitibus foliosissimis densis tecta.

I have more frequently found this species, without any lobed leaves at all, than with them, both during inflorescence and afterwards; and it is then that it would resemble *cucullata* so much, were it not for the constant pubescence, which, in the petioles, is always apparent, even when it nearly disappears in the leaves and scapes. Indeed, the lobed or palmate interior leaves are always scattered only, and the great majority cordate, cucullate or reniform, growing in very dense and large tufts. All have a tendency to run down into the petiole, though not equally striking in all specimens. The whole habit is very different from *palmata;* and as I have studied it in many specimens for several years, I can aver with confidence, that no degeneration of the one into the other takes place. I find this species chiefly on cultivated grassy, steep hill sides and on meadow margins. It begins to flower early in April and continues into May. Not unfrequently tufts are met with of more than one foot diameter. The oblique scaly root then often exceeds an inch in thickness. This species is very often found with flowers remarkably variegated, with white blotches, in an irregular way. As observed, the constant pubescence distinguishes it from *cucullata:* to point out the main characteristics that separate it from palmata I thus contrast them :

V. *palmata.*		V. *asarifolia.*
Fol. raris *integris ;* plur. *palmat.* null. cucull.	=	raris *palmat.* plurim. *cordato-cucullatis*
Petiol. tenuioribus interd. glabris.	=	semiteretibus validis semper pilosis.
Stipul. radic. lanceolatis integris.	=	saepe divisis, multo longioribus.
Scapis longitudine foliorum.	=	brevioribus foliis
Petalo infimo omnino glabro.	=	barba rara obsito.
Stigmate depresso marginato.	=	globoso-immarginato.

CAESPITIBUS paucifloris et paucifoliosis = foliosissimis densis, et floribus frequent.

4. Species. V. *sagittata.* Aiton.

Willdenow. Spec. p. 1160. n. 4.
Persoon. Synops. p. 254. n. 4.
Pursch Fl. p. 172. n. 4.
ibid. *dentata* n. 5. a mere var.
Nuttall. p. 147. n. 3.
Elliott. p. 299. n. 8.
Muhl. Cat. n. 5, by specimens.
New-York Cat. p. 28. n. 3.

V. acaulis. *Foliis* primariis raris lanceolato-cordatis, breviter petiolatis, exterioribus, crenato-dentatis. (saepe omnino carent.) Secundariis longe petiolatis, frequentioribus, longis, oblongis, vix acuminatis, margine serratis, basi cordato-sagittatis, incisis, i. e. dentibus elongatis, majusculis distantibus munitis, ceterum glabriusculis, aut pag. superiori pubescentibus. *Petiolis* plerumque folia longitudine excedentibus, semiteretibus, pilosiusculis. *Stipulis* radicalibus longissimis, glabris, lineari-acuminatis.

Floribus inversis, mediocribus, purpureo-coeruleis, in scapis longis. *Petalis* oblongo-ovatis, intus albescentibus, omnibus albo-barbatis, excepto inferiori nudo; omnibus eleganter purpureo-venosis. *Cornu* obtuso, postice producto. *Calycis* laciniis glabris, marginatis, lanceolatis, acuminatis. *Stigmate* rostrato, depresso, marginato.

Scapis filiformibus, subquadratis, folia interdum excedentibus. *Stipulis* alternis, minutis, distantibus, infra medium sitis.

Capsulis glabris, stylo coronatis.

Radice corallina brevi incrassata; caespites sparsas efformante.

β var. emarginata Nuttall p. 147. foliis fere triangularibus.

γ var. *dentata* Pursch p. 172. n. 5. foliis basi truncatis.

This species, although certainly heterophyllous, is so well distinguished by the long-petiolated, oblong, hastately dentate leaves, that it is not likely to be mistaken. I coincide with Mr. Nuttall in regarding his *emarginata* and the *dentata* of Pursch as varieties. I have met with both here rarely. Indeed the *sagittata* itself occurs but rarely with us. Elegant specimens have been found at Chapel-Hill by Professor Mitchell. It appears to be more common towards the north and flowers with us, end of April. In the variety *emarginata* the scape is often a foot long and exceeds the length of the leaves, notwithstanding these are uncommonly long-petiolate. The color of the leaves is remarkably blueish green as in V. primulaefolia.

5. Species. V. *triloba*. Nobis.

With some diffidence I venture to propose this new species, notwithstanding its striking characters, because I have found it but rarely. I have however met with it twice or thrice in different years, and in different places—videlicet rich woodland and meadows—constantly under the form here described. At all events it deserves to be pointed out for further observation.

V. acaulis. *Foliis* biformibus; alteris exterioribus lato-reniformibus, margine grosse crenato-dentatis, sinu rectilineo integro; alteris interioribus trilobis. Lobo medio ovato, grosse dentato, acutiusculo. Lobis binis lateralibus, aequalibus, subbidivisis, basi rotundatis, hastatim expansis, margine dentatis. Nervis prominentibus in omnibus. Foliis ceterum glabriusculis aut raris pilis obsitis, colore lutescenti-viridi. *Petiolis* marginatis, glabriusculis, longiusculis, praesertim in foliis trilobatis. *Stipulis* radicalibus breviusculis, lanceolatis, glabris.

Floribus coeruleis, eleganter venosis, subnutantibus. *Petalis* ovatis purpureo-striatis, albo-barbatis, barba longiuscula. *Nectario* minori. Superioribus et lateralibus basi attenuatis. *Calycis* laciniis glabris, lato ovatis, marginatis.

Stigmate recurvo, marginato, depresso.

Scapis brevioribus foliis, angulatis glabris. *Stipulis* minutis distantibus.

Capsula ignota. *Radice* crassa, undique radiculosa.

The whole plant has a glabrous habit, although the leaves are sparingly beset with short hair: they are of a remarkable yellowish green color and spread considerably, although but few in number with but few flowers in the tuft. I have found this Viola only late in spring. It approaches nearest to some varieties of *palmata* from which, however, its whole habit appears to separate it.

Remark.—The foregoing are all the species of heterophyllous Violae acaules, I have observed, or been able to regard as distinct species. Mr. Elliott's var. d. *heterophylla* of palmata, with which I am unacquainted, almost appears to be a distinct species, among the rest, on account of its growth in swamps—where I have never met with any of the recited species. I could however not presume to decide on a plant entirely unknown to me.

The following species, no longer labor under the difficulties of the former. Nevertheless several of them require close examination, in order to be properly distinguished, This is the case between the two V. *cucullata* and *obliqua*, and again between *villosa* and *cordifolia*, so much so, that Mr. Nuttall thinks them the same. My observations upon the two former have led me to conceive, that they ought to be distinguished; as likewise the two latter, where however, I am not perfectly acquainted with *cordifolia*, having seen only dry specimens. The characteristics I have to propose, have been formed upon very often repeated examinations of hundreds of individuals, and will I believe be found to hold good in most instances; though possibly single plants may occur, of so indefinite an appearance, that it may be difficult to determine them. But this happens in almost every Genus which has a number of Species.

6. Species. V. *ovata.* Nuttall.

Pursch. Fl. p. 173. n. 9 *primulaefolia* exclus. Synon. Willdenow.

Muhl. Cat. p. 27. n. 12 *ciliata* by Specimens; altogether the same.

Nuttall p. 148. n. 4.

Although Mr. Elliott cites Pursch to his *primulaefolia* it is clear that he describes the true Linnean one and not the present species.

New-York Cat. p. 28. n. 6.

V. acaulis: *Foliis* oblique ovatis, acuminatis, basi subcordatis in petiolos decurrentibus, eosque alatos reddentibus, crenatis, ad basin saepe lacerato-dentatis, utrinque pubescentibus (rarius aetate provectiori glabriusculis.) *Petiolis* brevioribus, statu juniori brevissimis, pilosis. *Stipulis* radicalibus lato-lanceolatis, oblique acuminato-truncatis, in truncatura dentatis, ceterum ciliatis, uncialibus, petiolum basi amplectentibus. Foliis nervosis.

Floribus maxime nutantibus, majusculis, pulchre coeruleis. *Petalis* obovatis; binis lateralibus longiuscule albobarbatis et subvenosis; infimo purpureo-venoso, barba sparsa: superioribus nudis. *Cornu* aut nectario obtuso. *Calycis* laciniis subreflexis, pilosis, oblongo-lanceolatis, postice elongatis attenuatis. *Stigmate* recurvo subrostrato, non depresso.

Scapis tetragonis, saepe sursum tortiusculis, pilosis, demum elongatis. *Stipulis* linearibus oppositis.

Capsulis glabris. *Radice* perpendiculari crassa. *Caespitibus* foliosis compactis, habitu stricto, crescit, plerumque undique canopubescentibus.

It is surprising that Mr. Pursch should have combined this extremely distinct species, having a very predominant habit of pubescence and large bright blue flowers, with the Linnean *primulaefolia*, whose habit and manner of inflorescence is so widely different. Mr. Nuttall excellently points out the distinction. The present species invariably grows on dry sunny hills—preferring a gravelly soil and flowers early in April; the other, rather later, always adheres to moist swampy places, and is much more nearly allied to *lanceolata* and *blanda* than to this. Nuttall says the scape of *ovata* is shorter than the leaves. I have found it so, in a few instances in very dense tufts; in general however the scapes are much longer than the leaves whose petioles are at first unusually short. I have met with glabrous specimens in peculiar situations; otherwise the pubescence is pretty constant, and especially striking on the margins of the leaves; which caused Muhlenberg to call this species *ciliata*. It is common with us.

7. Species. V. *cucullata*. Aiton.

The difference between this and *obliqua* of Aiton, I am satisfied, is a specific one, and the diagnostic characters constant. Besides the general habit, these are however only to be ascertained by minute examination. Hence, I presume, specimens of the one have been often mistaken for the other, which appears to have induced Mr. Nuttall to reject the *obliqua* altogether, the name of which, is certainly very inadequate. I have done my best to make out the synonymy to each, without being perfectly certain in every instance.

Willdenow p. 1162. n. 7. appears decidedly to belong to *cucullata*.

Persoon Synops p. 254. n. 8. likewise.

Pursch. Fl. p. 173. n. 10—is slightly characterised as *cucullata ;* but probably is intended exclusively as such.

Elliott p. 298. n. 6—refers probably to both. Some part of his description belongs to *cucullata* beyond a doubt—the want of beard on the lower petal however points to *obliqua* ; thither I refer the *cordata* of Walter.

Pursch Fl. p. 173. n. 12. V. *papilionacea* is certainly but a variety. I have often met with yellow bearded specimens—and can find no other distinguishing mark.

Muhl. Cat. n. 11. by specimens.

Nuttall p. 148. n. 5. applies to both.

V. acaulis. *Foliis* cordatis, basi cucullatis, dentato-serratis, glabris, venosis. *Petiolis* subcanaliculatis, glabris, brevioribus sequente. *Stipulis* radicalibus, minoribus, linearibus, marcidis, ciliatis.

Floribus oblique flexis violaceis, coeruleis, saepe exalbidis. *Petalis* latioribus; infimo, limbo rotundato, barbato. Binis lateralibus etiam barbatis. *Barba* longa rigida cylindracea. Petalis omnibus intus albescentibus. *Calycis* laciniis glabris lanceolatis.

Scapis brevioribus, teretibus; *stipulis* minutis, infernis, alternis.

Capsulis glabris. *Radice* crassiuscula, radiculosa.

With us this is the earliest of all and common in March. At first it is generally very low, and flowers before many leaves are expanded. It varies considerably in the relative length of scape and leaves as it advances, and forms considerable tufts in grassy spots and meadows almost every where; but it is less exclusively attached to moist places. The cucullate form of the younger leaves (the angles at base involute) is common to both species, although more conspicuous in this and generally disappears after the leaves are full grown. The whole plant is perfectly glabrous, but opake. Lobed leaves do rarely occur, as anomaliès, I think--but a purplish cast is frequently observable on the lower surface.

8. Species. V. *obliqua.* Aiton.

Wildenow p. 1161. n. 6. *Persoon* Synops p. 254. n. 7.

Pursch p. 172. n. 8. *Muhl.* Cat n. 9. by specimens.

Walter's cordata and *Elliott's* cucullata in part.

V. acaulis. *Foliis* non tam cucullatis, minoribus, strictioribus, ceterum similibus prioris, glaberrimis saepe splendentibus. *Petiolis* canaliculatis longissimis (folia multoties excedentibus) glabris. *Stipulis* radicalibus magnis, uncialibus, lanceolatis, acuminatis, ciliatis.

Floribus oblique flexis, ime coeruleis (saepius coloris Indigo.) *Petalis* omnibus angustioribus, basi albescentibus, venis luteis et purpureis pictis. Binis lateralibus barbatis,

barba brevissima, globoso-clavata. Infimo nudo, limbo acuto nec rotundato, postice naviformi, carinato. *Calycis* laciniis glabris, submarginatis, oblongis acutis.

Scapis quadratis, canaliculatis, longioribus foliis. Stipulis binis brevissimis versus apicem scapi sitis.

Capsulis glabris. *Radice* saepe obliqua parum radiculosa.

The general habit of this species, is much taller and stricter than the former species. The flowers have a remarkably deep blue or indigo color with scarcely a tint of red in them. It is almost exclusively found in swampy meadows, or on the grassy margin of small branches. Not rarely it flowers there indiscriminately with the former, although it begins to appear rather later. The following contrast of the characteristics will serve to distinguish the two species.

	V. *cucullata*		V. *obliqua*
Stipulis radical:	minoribus, linearibus.	=	majoribus, uncialibus, lanceolatis.
Scapis :	teretibus, brevioribus.	=	quadratis, longioribus.
Petalo infimo :	rotundato, barbato.	=	limbo acuto, carinato, imberbi.
Barba lateralium;	magna, cylindrica.	=	brevissima, globoso-clavata.

9. Species. V. *villosa.* Walter and Elliott.
Elliott. p. 297. n. 3. *Walter.* p. 219.

Nuttall, p. 148. n. 6. exclusive of var β *cordifolia.*

Muhl. Cat n. 2. *barbata*, by specimens, confounded however with *cordifolia.*

The *Sororia* of Pursch and Willdenow belongs decidedly to the next, which I think specifically different.

V. Acaulis. *Foliis* rotundato-cordatis ac reniformibus, obtusis, crenatis, terrae adpressis planissimis tenuioribus; sinu parvo sed aperto, rectilineo, integro; pagina superiori pilis longis pubescentibus, immo pube canescentibus; variegatis venis purpurascentibus, demum et in siccis evanidis; pagina inferiori, glabris, purpureo tinctis. *Petiolis* brevioribus, glabris, marginatis, diffusis. *Stipulis* radicalibus minutis, purpurascentibus.

Floribus minoribus, horizontalibus, rosaceo-purpureis. *Petalis* limbo rotundatis, postice attenuatis; lateralibus, barba longa alba; infimo nudo, fundo albescenti, purpureo-striato. *Calycis* laciniis glabris, punctatis, non ciliatis sed margine albescenti undulato, postice auriculatis. *Stigmate* deflexo, marginato, cupulaeformi.

Scapis longioribus foliis, subangulatis, glabris, rubro punctatis. Stipulis minutis, oppositis, versus basin sitis.

Capsulis scabriusculis. *Radice* tenui obliqua, mox in radiculos abiente.

Caespitibus paucifoliosis, saepe bifoliis crescit—sub uniflora.

A very late flowering species, and found by me exclusively on steep shady hill sides, looking to the north, where Anemone hepatica usually grows. The leaves are always few, and flat, incumbent on the ground and in a fresh state, generally veined purplish and white, and much smaller than of any of the preceding species. The veined appearance vanishes when dry. They are rather more consistent than the leaves of the former species but not near as thick as in the following. The opening of the sinus is small and by a rectilinear slant, without serratures. It flowers late in April and in May. No kind of affinity to V. *Sagittata.* The long hirsute pubescence of the upper surface of the leaves, gives them frequently a hoary aspect.

10. Species. V. *cordifolia.* Nuttall.

Willdenow in Hort. Berol. 1. T. 72. *Sororia.*

Pursch, p, 173, n. 11. *Sororia.*

Nuttall, p, 148, n. 6. var β. *cordifolia.*

V. acaulis. *Foliis* crassis, orbiculato-cordatis, sinu clauso rotundato, crenatis, planis, terrae adpressis, pagina superiori hirsutis, subtus glabris. *Petiolis* validis, brevissimis, flexuosis, quasi alatis, glabriusculis. *Stipulis* radicalibus, minutissimis, subulatis.

Floribus rosaceo-coeruleis. *Petalis* breviusculis obovatis; binis lateralibus sparsim barbatis, ut etiam infimo, omnibus multistriatis. *Calycis* laciniis angustis, brevibus, obtusiusculis, glabris, postice vix productis. *Stigmate* parvo, rostrato, depresso.

Scapis longitudine foliorum. *Stipulis* minutissimis.

Capsula glabra. *Radice* brevi tenuiuscula radiculosa. *Caespitibus* subfoliosis, floribus frequentioribus crescit.

Although I have seen this species only in dry specimens from Pennsylvania and Virginia, where it was picked up by my esteemed friend Rev. C. F. Denke, in the mountains, I conceive it ought to be separated from the *villosa* of Elliott, on account of the general habit, the very thick leaves, with a sinus not only roundedly closed, but frequently lapping over, the very short thick bent petioles, very small radical stipules and smooth fruit. The shape of the petals is like-

wise different, and that of the laciniae of the Calyx still more strikingly; not to mention the stigma. Mr. Z. Collins of Philadelphia has before me, according to Nuttall, considered this a distinct species—and it is assuredly the *sororia* of Wildenow.—*May.*

Note. The following species so amply described by Mr. Nuttall and Michaux is the only one of this family, with which I am utterly unacquainted; as I have never met with any *stemless* viola having yellowish flowers. It appears to me to form a transition from the bluish petalled acaulescent Violae, to the white petalled ones; which upon the whole are so manifestly different, in their whole habit of inflorescence, that a very good subdivision of the family might be established, dividing it into: a) Violae acaules, floribus *papilionaceis*, majoribus, coerulescentibus: (b) Violae acaules, floribus *regularioribus*, minoribus, candidis, between which V. *rotundifolia*, would be intermediate, and *clandestina* an appendix.

The white flowers sometimes and indeed frequently met with in all the foregoing species, all shew, that it is owing to a fading of the blue that they are white, while those of the proposed white subdivision as plainly demonstrate the contrary; besides their difference of shape and size.

11. Species. V. *rotundifolia.* Michaux.

Nuttall p. 149. n. 7. *Michaux* p. 150.

Elliott p. 298 n. 4.

V. acaulis. *Foliis* crassis, magnis, orbiculato-cordatis, sinu clauso, leviter dentatis, terrae adpressis, glabriusculis. *Petiolis* pubescentibus. *Floribus* lutescentibus, in scapis brevibus ante foliorum expansionem. *Petalis* binis lateralibus striatis, subbarbatis, striis 3, barba interruptis, infimo minori, striis bifidis, lineis cartilagineis transversalibus. *Calycis* laciniis oblongis obtusis. *Stigmate* glabro, minori, recurvo in stylo brevi crasso.

Scapis brevibus. (Nuttall.)

This remarkable species has been found on the shady banks of Wishahikon near Philadelphia by Mr. Rafinesque and Nuttall; the latter has likewise met with it in the mountains of North-Carolina. I have not been so fortunate as yet. It is undoubtedly a very distinct species. Mr. Pursch has very improperly cited Michaux's plant to his *clandestina* with which it can have no affinity whatever.

12. Species. V. *lanceolata.* Linn.

Willdenow, Spec. p. 1161. n. 5. *Elliott,* p. 296. n. 1.
Persoon, Synops. p. 254. n. 5. *Muhl,* Cat, n. 6, by Specimens.
Michaux, p. 150. *New-York,* Cat, n. 4.
Pursch, Fl. p. 172. n. 6. *Nuttall,* p. 150. n. 10.

I conceive it doubtful whether the Siberian plant of the same name, as described by Gmelin, actually is this species. Willdenow never saw either.

V. acaulis. *Foliis* glabris, nervis suboppositis, lanceolatis, angustis, longiusculis, basi in petiolos sensim attenuatis, obtusiusculis, subserratis. *Stipulis* radicalibus lineari-lanceolatis integris. *Petiolis* brevioribus foliis et cum his stricte erectis.

Floribus solitariis, candidis, parvis, regularibus, nutantibus in scapis apice incurvis. *Petalo* infimo, purpureo-striato; omnibus imberbibus, subaequalibus, (*Elliott.* 2 lateralibus barbatis.) *Calycis* laciniis angustis, acutis, glabris. *Stigmate* recurvo, rostrato, in stylo brevi, capitulo emarginato. Inodorata. *Capsulis* trigonis glabris. *Radice* perpendiculari tenuiuscula.

This beautiful species I have never seen growing; although I have excellent specimens, from Canada, Pennsylvania and the Cherokee country. Mr. Elliott cites it as common in the Southern pine barrens, although rare on the sea coast. Mine are all beardless, perhaps Mr. Elliott's may be a variety. This species is nearly related to the following, but the narrow lanceolate leaves so remarkably attenuated into the petiole and its perfect glabrosity, distinguish it sufficiently.

13. Species. V. *primulaefolia.* Linn.

Wildenow, p. 1162, n. 8. *Elliott,* p. 297, n. 2. exclus. Synon. Pursch.
Persoon, p. 254. n. 9. *Nuttall,* p. 149. n. 9.
Muhl. Cat. n. 7. by specimens. *New-York,* Cat. n. 7.

Pursch has most probably confounded it with his *lanceolata.*

This is likewise a native of Siberia.

V. acaulis. *Foliis* glabris aut tantum in nervis pilosis, oblongis, basi subcordatis abruptim in petiolos decurrentibus, apice obtusis, nervis pinnatim dispositis; omnino similibus foliis *primulae veris.* *Petiolis* junioribus rubicundis, subtus pilosis; demum longioribus foliis. *Stipulis* radicalibus glabris, longis, linearibus, acuminatis, sparsim ciliatim.

Floribus minutis, candidis, saepe obliquis; *petalis* subaequalibus. Infimo eleganter nigro striato; binis lateralibus

brevi-striatis, barba parca brevi obsitis; superioribus omnino candidis. *Calycis* laciniis obtusis. *Stigmate* manifestim rostrato, capitato.

Scapis rubicundis angulosis, longitudine foliorum. *Stipulis* oppositis subulatis supra medium sitis.

Capsulis glabris. *Radice* obliqua, fasciculosa, subsquamosa.

No doubt this is a very good species, although allied both to the former and the following one. It is the most common white Viola here and is found in wet meadows, ditches, and wet grassy spots in the woods, in April. The flowers are very odoriferous and uncommonly small in proportion to to the leaves, which often grow to an enormous size; exactly resembling those of Primula. The *Aecidium Violae* is not uncommon on this species.

14. Species. V. *blanda*. Willdenow.

Willdenow, Hort. Berol. I. T. 24. *Elliott*, p. 298. n. 5.
Pursch, p. 172. n. 7. *Nuttall*, p. 149. n. 8.
Muhl. Cat. n. 13. by Specimens.

V. acaulis. *Foliis* planiusculis, glabris aut superne pilis raris obsitis, lato-cordatis, nervis pinnatis glabris cum pagina inferiori; plerisque acutiusculis, raris rotundatis, remote serratis, colore luteo-viridi. *Petiolis* glabris, longiusculis, decumbentibus. Sinu foliorum subclauso, rotundato; foliis, substantia, tenuissimis.

Floribus albis, interdum lutescentibus, odoratis, parvis. *Petalo* infimo lanceolato, purpureo striato et venoso, barba tenuissima exornato; ceteris substriatis imberbibus. *Calycis* laciniis oblongo-linearibus obtusis. *Stigmate* capitato depresso, acute marginato, recurvato.

Scapis filiformibus, saepe decumbentibus. *Stipulis* subulatis in medio. *Capsulis* glabris. *Radice* fasciculosa.

I find this kind exclusively with us on mountain brooks and shady wet rocks; the leaves are generally spread flat on the ground and vary from a very small size, to a considerable one. They are always of a light yellowish green color and very thin consistence, resembling a good deal those of *clandestina*. Their number is generally small and distant. It has a handsome, delicate, small flower, remarkably fine scented. Flowers in April and May.

15. Species. V. *clandestina*. Pursch.

Pursch, p. 173. n. 13.

V. acaulis caespitosa. *Foliis* suborbiculatis, obtusiusculis, magnis. crenato-serratis, serraturis glandulosis; tenuibus, glabriusculis; Sinu clauso cordatis. *Petiolis* multo brevioribus foliis, glabris, aut pilis raris obsitis. *Stipulis* radicalibus, ovatis, latis, brevibus. *Stolonibus* floriferis.

Floribus ereconditis—i. e. foliis et ligno putrido tectis, minutis, chocolatis. *Petalis* linearibus, calyce vix longioribus. *Stylo* longiusculo. *Stigmate* recto capitato.

Scapis brevissimis, pilis adspersis; *Stipulis* subulatis in apicibus.

Capsulis glaberrimis subsplendentibus, saepe reconditis.

Radice stolonifera, radiculosa. *Caespitibus* foliosis.

Mr. Nuttall never having seen this plant, as it would appear, doubts of its authenticity, on account of the great anomaly in the petals, and is inclined to refer Pursch to *villosa.* With this species however it has no affinity, being nearest allied to *blanda.* But I think, whoever has seen even dry specimens, such as I received from my late friend Rev. H. Steinhauer of Bethlehem, found on the Pocono mountain, cannot possibly doubt the species. Mr. Steinhauer shewed me an elegant drawing he had made from fresh specimens; the petals exactly as described by Pursch, and shewing some affinity to *concolor* in their habit. It grows in large tufts, spreading its light green leaves in every direction. They are of thin consistence and sprinkled with hair on the upper side. My specimens have only apetalous flowers.

This species ought to be closer observed and better described. The vulgar appellation of *Heal all* which Pursch says it goes by, is applied to a great number of very different plants.

B. *Violae caulescentes. Violae producing stems.*

Species of Europe, belonging to this family:

1. V. *canina.* 2. V. *montana.* 3. V. lactea. 4. V. numularifolia. 5. V. cenisia. 6. V. *mirabilis.* 7. V. *biflora.* 8. V. *tricolor* var. bicolor. 9. V. *arvensis.* 10. V. *Rothii.* 11. V. rothomagensis. 12. V. *lutea.* 13. V. *grandiflora.* 14. V. zoysii. 15. V. *pumila.* 16. V. *calcarata.* 17. V. *cornuta.*

Those in Italic are in my collection.

Remarks.—The *caulescent* Violae of America appear to me to have been less accurately observed than the former family, although I think they are rather easier to be distinguished. A good number have been rather incautiously referred to such from whom they manifestly differ. I find it impossible to unravel the species generally received, without establishing some new ones; although I am persuaded that specimens of most of these, have been under the eyes of other Botanists, without being sufficiently distinguished. The attention which I have bestowed upon such, as grow in our vicinity (including the greater number) has, I hope enabled me to discriminate properly. The V. *striata* and V. *debilis* of authors appear to have been particularly loosely observed, and form an aggregate of very distinct species, rendering it altogether impossible to say which is meant in every instance. The V. *ochroleuca*; V. *repens*; V. *debilis*; and V. *uliginosa* attempted to be here correctly established, have, I have reason to presume, been comprehended hitherto under one or the other of the above two names. My V. *striata* is altogether a different species from these, and has probably not been before observed. It was first pointed out to me in our vicinity, by Mr. John Leconte, who was of opinion that it had been no where described. I call it *striata* with him, because that name certainly belongs more appropriately to this Viola, than to any of those to which it has before been applied. The *stricta* of authors comprizes as I judge, my two species V. *ochroleuca* and V. *repens*. (I should have named the latter *decumbens* if there was not already a species of that name indigenous to the Cape of Good-Hope.) My *striata* approaches nearer to V. *pubescens* and *eriophora* than to the above.

With regard to the caulescent Violae in general it may be observed that they appear later in the season than the former family; and have a marked predeliction for the yellowish color in their flowers.

Besides the alterations above recited, I have ventured to propose a new species in a very handsome little Viola from Labrador, with which I begin, as it is apparently the least caulescent of the family.

16. Species. V. *punctata*. Nobis. from Labrador.

Perhaps somewhat related to V. *uniflora*. Pers. n. 28. of Siberia, from which it differs however by Willdenow's re-

mark, that that bears yellow flowers. Besides the description of both authors contains none of the characteristics of ours.

V. caulescens; *caule* breviusculo, tenui, stolonifero, paucifolioso, simplici, subunifloro. *Stipulis* radicalibus et ad basin caulis, lineari-lanceolatis ciliatis; axillaribus longissimis lineari-acuminatis.

Foliis radicalibus caespitosis,caulinis suboppositis; omnibus longe petiolatis, exacte cordatis, obtusiusculis, parvis, crenatis; pagina superiori punctis glandulosis elevatis tectis, inferiori impressis; ceterum venosis, substantia crassiuscula, pagina superiori vix perceptibiliter hirtis, subtus glabris. *Petiolis* glabris.

Floribus majusculis, coeruleis, in *pedunculo* longiusculo, solitario, anguloso; stipulis binis oppositis lanceolatis versus apicem sitis. *Petalis* rotundatis majusculis; lateralibus tenuissime albo-barbatis. *Nectario* longiusculo, recurvo, rostro recurvo terminato. *Calycis* laciniis lanceolatis, acuminatis, glabris, postice rotundatis productis.

Caulis infra caespitem foliorum incrassatus, in *radicem* longam abiens. *Capsula* deest.

The horn of the lower petal or nectarium is highly remarkable, terminating by a bend upwards in a short recurved rostrum. The leaves have some resemblance to those of Pyrola uniflora and differ from all other Violae by their glandular punctures. In all my specimens, there is but one flower to the stalk, and that considerably elevated above the leaves by a long peduncle. I received this interesting species, among a considerable collection of Labrador plants, from my revered friend, R. Rev. C. G. Hueffel now of Bethlehem.

17. Species. V. *canadensis*. Aiton and Linn.

Wildenow p. 1166 n. 17. Nuttall p. 150 n. 11.
Persoon Syn. p. 254 n. 20. *Muhl.*Cat. n. 15 by specimens.
Pursch p. 174. n. 14. *Michaux* p. 150.
Elliott p. 301. n. 11. *New-York* Cat. n. 9.

V. caulescens; *Caule* altissimo erecto subsimplici, nudiusculo i. e. apice foliosiori, tereti, glabro.

Foliis alternis in axillis floriferis, cordatis, basi latissima, longe acuminatis, dentatis serratis, subtus pallidis, glabris, in pagina superiori pilis raris adspersis, luteo-viridibus, quasi angulo recto e petiolis reflexis, nervosis, magnis, tenui-

bus. *Petiolis* folio brevioribus, in summis brevissimis. *Stipulis* axillaribus binis oppositis, erectis, lato-lanceolatis, marcidis, integris.

Floribus majusculis, extus roseo-coerulescentibus—intus albescentibus, in *pedunculis* axillaribus brevioribus foliis, stipulis linearibus sub apicem. *Petalis* longis angustis, lateralibus subbarbatis, striatis. *Cornu* obtuso vix producto. *Calycis* laciniis longe acuminatis, glabris, albo-marginatis. *Stylo* brevi compresso; *stigmate* capitato, pubescentia conspicua utrinque. *Capsula* leviter pubescente. *Radice* tenui.

A tall growing elegant species, found here exclusively in our higher mountains and there rarely. It appears to be more common to the north; and often attains a height of ten or more inches, with a proportionably slender stem; below there are but few leaves. The flowers are remarkable for the shortness of the horn or nectary and the long attenuated narrow petals. These are purple outside and whitish within, finely striated. Willdenow's description is a very good one. It flowers late in May and beginning of June. Northwardly it seems by the New-York catalogue to flower still later, in July. It is difficult to express the manner in which the leaves are almost rectangularly bent down—but it is a striking habit to the observer.

18. Species. V. *ochroleuca.* Nobis.

Wildenow. p. 1166. n. 18. *striata?*

Persoon p. 255. n. 21. *striata.*

Pursch. p. 174. *striata* very uncertain to which he refers.

Nuttall p. 150. n. 12. *striata* decidedly our species.

The *striata* of Elliott I think must belong to my debilis, as does the *striata* of Muhl. Cat. by specimens.

I have very particularly studied this and the two following species—and feel satisfied that they are specifically very distinct.

V. caulescens: *Caulibus*, erectiusculis, ramosis, foliosis a basi, angulosis, crassis, glabris, purpurascentibus.

Foliis omnibus minoribus longiuscule petiolatis, alternis, diffusis; inferioribus rotundato-cordatis, crenato-serratis, obtusis; superioribus paulo majoribus, breviter acuminatis. Omnibus pagina superiori minutim pubescentibus, subtus solummodo in nervis. *Stipulis* axillaribus oppositis,

maximis, oblongo-lanceolatis, margine dentibus majusculis distantibus quasi ciliatis. *Petiolis* canaliculatis glabris.

Floribus maximis, ochroleucis, aut pallide sulphureis, nutantibus in *pedunculis* longioribus foliis, filiformibus, apice longissime stipulatis, stipulis linearibus acuminatis. *Petalis* magnis, limbo rotundatis, basi attenuatis. Binis lateralibus barba concolore profuse tectis, ceteris nudis; infimo striis nigris picto. *Cornu* postice longiuscule producto, obtuso. *Calycis* laciniis longissimis angustis, acuminatis, margine ciliato. *Stigmate* recurvo subpubesc.

Capsulis glabris. *Radice* tenuiuscula.

This is by far the largest flowered species of the family. The stem rises in spreading tufts to a considerable height, generally in a half bent way. It flowers in abundance before the leaves are fully expanded, and is highly remarkable for the unusual ochre-color of its fine flowers. I have met with it in borders of ponds and meadows in April and along Dan river, towards the Saura mountains, attached to rich soil. The next, is the only species with which it is nearly allied—but can readily be distinguished by its size, erect habit, and very differently shaped stipules.

19. Species. V. *repens* Nobis.

If observed by others, it has been comprehended among the former in such a manner, as to render it impossible to point out references.

V. caulescens, decumbens, subrepens, stolonifera. *Caulibus* crassiusculis subangulosis, ramosis, foliosis, decumbentibus, minoribus quam in priori. *Stolonibus* longe lateque irrepentibus. *Stipulis* maximis, ovato-lanceolatis, margine ciliis longissimis viridibus densis exornatis, ex axillis foliorum, cauli undique adpressis, fere ut in Violis stipulaceis europaeis.

Foliis inferioribus reniformibus, acutis, crenatis, glabriusculis, aut ut in priori: superioribus cordatis, subcucullatis, dentato-serratis. *Petiolis* longiusculis, glabris, submarginatis. Folia omnia minora quam in priori.

Floribus minoribus ex luteo-albescentibus. *Petalo* infimo multo minori ceteris; lateralibus barba longa *alba*. *Nectario* breviusculo. *Calycis* laciniis lanceolatis, multo latioribus quam in priori, substriatis, acuminatis, ciliatis. *Pedunculis* axillaribus breviusculis, in ipso apice longe stipulatis.

Capsula non observata. *Radice* ut in priori.

This is of a much smaller size than the former and well distinguished by its decumbent, spreading and even creeping growth, smaller flowers and their white beard, but no less, by the broad and strongly fringed opposite stipules, which at first might be taken for pinnatifid ones, and the very small lower petal. It has been found here exclusively on the rocks of the Saura mountains, where it forms considerable patches. It flowers in May. I contrast the two Species thus :

V. *ochroleuca.*		V. *repens.*
CAULIBUS assurgentibus, erectis, majoribus	=	decumbentibus, stoloniferis minoribus.
FOLIIS cordatis, obtusis ac acuminatis	=	reniformibus et cordatis, minoribus.
Floribus maximis ; barba concolore	=	minoribus ; barba alba.
Petalo infimo magno, rotundato	=	minutissimo, aequali.
Stipulis axillaribus margine dentibus distantibus dentatis, maximis, oblongis	=	margine longissime denseque ciliatis, magnis ovatis, caule adpressis.

20. Species. V. *debilis.* Michaux.

Michaux. p. 150. *Elliott striata* p. 301. n. 12.

Pursch p. 174. n. 16. *Walter canina ?* p. 219.

Nuttall p.150. n. 13. *Muhl. Cat. Striata* n. 17 by specimens.

I have some suspicion that Elliott's specimens collected by Dr. Macbride may belong to the *uliginosa* of Muhlenberg, called *asarifolia* in his catalogue. The rest of the synonymy I believe is correct.

V. caulescens, glaberrima, decumbens et erecta. *Caulibus* caespitose ex radicibus provenientibus, foliosis, brevibus.

Foliis reniformi-cordatis, obtusiusculis, basi saepe cucullatis, saepe suborbiculatis, crenatis, utrinque glaberrimis, e sinu quasi in petiolos subdecurrentibus ; minoribus. *Petiolis* diffusis longiusculis. *Stipulis* axillaribus lato-lanceolatis subdivisis, ad basin tantum serrato-ciliatis.

Floribus pallide coeruleis, nutantibus in pedunculis *medio* stipulatis, longiusculis, axillaribus, folia excedentibus. *Petalis* omnibus limbo rotundatis, binis lateralibus parce barbatis ; infimo venoso. *Nectario* longo, postice valde porrecto, attenuato. *Calycis* laciniis linearibus, angustis, glabris, albo-marginatis, postice truncatis. *Stigmate* tubulosso, rostrato, papilloso.

Radice obliqua, longiuscula, radiculosa. *Capsula* non observata.

There is an approach to V. *rostrata* apparent in this distinct species, though the nectary is only half as long. It is rare with us, and attached only to our mountains. The lower petal is very broad *in limbo*. On Hunting creek, Surry county, I met with a very erect variety. The pale blue color is unusual too.

21. Species. V. *uliginosa*. Muhlenberg.

Muhl. Cat. asarifolia et uliginosa. n. 18. by specimens.

Elliott refers to this, page. 299.

New-York Cat. uliginosa p. 28, n. 10. This is very probably our species.

V. caulescens. *Caulibus* debilibus tenuibus, assurgentibus, flexuosis, ramosis, inferno nudis.

Foliis constanter cordato-acuminatis, serratis, majoribus, distantibus, alternis, glabris aut tantum in nervis pilosiusculis. *Petiolis* longitudine foliorum aut brevioribus. *Stipulis* axillaribus acuminato-lanceolatis tenuiter ciliatis; latioribus in caule.

Floribus minutissimis pro ratione, in *pedunculis* filiformibus, axillaribus, flexuosis, longitudine foliorum, apice subulato stipulatis. *Petalis* coerulescentibus, angustis ; infimo longiuscule albo-barbato. *Nectario* brevissimo non porrecto.

Calycis laciniis longis, acuminatis, margine ciliatis.

Radice fasciculosa, radiculosa. *Capsula* deest.

This species I have never seen in a fresh state; but have very frequently had it sent to me from the Cherokee country with remarkably constant appearance. The stem has generally but few leaves, larger than in the former species, and well distinguished by their cordate acuminate shape. The acumen is always somewhat obliquely turned—and the assurgent stem generally a little zigzag. The very small flowers—least in size of any blueish violet, with nearly equal petals, resembles a little the white flowered Violae of the former family. The short nectary at once separates it from *debilis*. It appears to grow high—as I have specimens which exceed eight inches. The time of flowering is unknown to me. Muhlenberg found it in Pennsylvania in April.

22. Species. V. *rostrata*. Muhlenberg.

Pursch. p. 174. n. 17. *Muhl.* Cat. n. 21. by specimens

Nuttall p. 150. n. 14. *Torrey*. New-York by specimens.

V. caulescens; glabra. *Caulibus* diffusis, e radice foliosis, erectis, angulatis.

Foliis cordatis acutis, glabris, eroso-dentatis; inferioribus longe-petiolatis, ceteris breviter. *Stipulis* axillaribus lanceolatis, serrato-ciliatis. *Petiolis* glabris, marginatis.

Floribus coeruleis, *nectario* longissimo, rostrato, porrecto, corollam duplo excedente. *Petalis* omnibus imberbibus, extus purpureis. *Pedunculis* duplo longioribus foliis, medio stipulatis, stipulis alternis. *Calycis* laciniis brevibus, acuminatis. *Stigmate* glabro, erecto, attenuato-clavato, erostrato.

Capsula deest. *Radice* perpendiculari non radiculosa.

This very distinct Viola does not grow with us, and probably not in the Southern States. Very handsome specimens from Pennsylvania and from Albany, New-York, are in my collection. It grows on shady rocks.

23. Species. V. *tripartita*. Elliott.

Elliott, p. 302. n. 14.

Nuttall, p. 150. n. 16.

V. caulescens; pilosa; *caule* simplicissimo, teretiusculo, subpedali; apice tantum folioso.

Foliis paucis in summo caule, profunde tripartitis, lobis lanceolatis dentatis: pagina inferiori, praesertim in nervis pilosis. *Petiolis* breviusculis pilosis. *Stipulis axillaribus* minutis villosis, ovatis aut lanceolatis, integris aut subserratis, medio nervo percurrente costatis.

Floribus mediocribus luteis, in *pedunculis* axillaribus filiformibus, brevibus, medio stipulatis. *Petalis* superioribus purpureo-striatis, non barbatis. *Nectario* brevissimo, vix producto, obtuso. *Calycis* laciniis breviusculis acutis. *Stigmate* globoso pubescente.

Radice fasciculosa, ex radiculis paucis crassis. *Capsula* non visa.

No doubt this species, as Mr. Nuttall observes, belongs to the relationship of *pubescens* as well as the two following ones; but it is obviously a distinct species, being the only caulescent Viola with lobed leaves. We have met with it in our neighbourhood very rarely indeed, but in good specimens agreeing with Mr. Elliott's description in every respect, only, not exceeding six or eight inches in height. The petals have outside in some instances a purplish cast like those of hastata, and like that it begins to flower before the leaves are fully expanded. It was found in shady woods in May.

24. Species. V. *pubescens*. Aiton et Linn.
Willdenow, p. 1166. n. 19. *Michaux*, p. 149. *pennsylvanica*.
Persoon, p. 255. n. 22.
p. 255. n. 23. *pennsylvanica* appears not to differ.
Nuttall, p. 150. n. 15. *Muhl.* Cat. n. 16. by specimens.
Pursch, p. 174. n. 18. *New York*, Cat. n. 11.

V. *caulescens*, tota villosa pubescens. *Caulibus* subteretibus, simplicibus, erectis, villosis, apice tantum foliosis; subangulosis.

Foliis lato-cordatis magnis, eroso-dentatis, plus minusve longe acuminatis, utrinque pilosis, villosis, canescentibus, nervis prominulosis; breviuscule petiolatis. *Petiolis* canaliculatis in folia dilatatis. *Stipulis* axillaribus marcidis, ovatis, villosis, subserratis mediocribus.

Floribus majusculis, luteis; in pedunculis axillaribus, brevioribus foliis, villosis, versus apicem incurvis, stipulatis. *Petalis* lateralibus albo-barbatis; infimo purpureo-striato (ut etiam lateralia;) superioribus minoribus, unicoloribus. *Nectario* abrupte inflexo acuminato. *Calycis* laciniis glabris aut villosis, ovato-lanceolatis, subobtusis. *Stigmate* globoso, utrinque pubescent.

Capsulis glabris (*Nuttall*; etiam villosis.)

Radice fasciculosa.

Stipulis in nuda parte caulis inferne, ovatis integris obtusis.

I scarcely know what to think of this species, so extremely different from the next in several momentous particulars; and yet apparently united by Nuttall therewith. The *pubescens* or *pennsylvanica* never is met with here, although I have frequently found it in the northern states myself, and am possessed of numerous good specimens—while the next is very common. Yet it is clear that the specific distinction cannot be rested on the smooth or villous capsule. I possess specimens of undoubted *pubescens* with perfectly smooth, and others with closely villous capsules. I must therefore conclude that the var β *eriocarpon* of Nuttall is not my *eriocarpa* as I at first supposed, but really a variety of pubescens; and that my next species does not occur in Pennsylvania; although I confess I do not feel perfectly satisfied upon the subject, and hope to be able to investigate it further. What I exclusively call *pubescens* is always remarkably pubescent, entirely erect, with very broad cor-

date acuminate yellowish leaves only at the summit, the caulis otherwise naked; sometimes a single long petiolate leaf proceeds, beside the stem, from the root. The curious and unusual shape of the nectary suddenly bent inwardly and pointed, forms the most striking feature of difference. I doubt whether this has been found in the southern states.

25. Species. V. *eriocarpa*. Nobis.

An *Nuttall* p. 150 n. 15. var. of *pubescens*?

I doubt the more that Nuttall's variety is my new species, as he expressly remarks, that in that the stipules are smaller, while the uncommon large size of the stipules in mine, forms a prominent distinction of it from *pubescens*. And yet Mr. Torrey of New-York informs me that Mr. Nuttall having seen a specimen of this among plants, I sent to Mr. Torrey, doubted of its being distinct. I describe mine thus.

V. caulescens, scabriuscula. *Caulibus* decumbentibus, demum assurgentibus, diffusis, crassiusculis, angulosis, flexuosis, glabris, a radice ramosis, foliosis.

Foliis ime cordatis, venoso-nervosis; saepe reniformibus, diffusis in *petiolis* longiusculis; margine dentatis saepe acuminatis. Pagina superiori opacis glabris, aut parum pilosiusculis: inferiori magis lutescentibus pilosis in nervis prominulis. *Petiolis* unilatere applanatis, pilis rigidis obsitis.

Stipulis axillaribus magnis, latis, ovatis, obtusis, semiamplexicaulibus, non marcidis, sed viridibus, margine ciliatis.

Floribus majusculis viridi-flavis, in pedunculis breviusculis axillaribus, versus basin minutim stipulatis. *Petalo* infimo nigro-striato; binis lateralibus barba tenuissima adspersis, striis paucioribus; superioribus minoribus nudis. *Nectario* brevi vix producto, obtuso. *Calycis* laciniis glabris, ciliatis acuminatis. *Stigmate* deciduo in stylo longo, globoso, utrinque pilis ornato.

Capsulis magnis, ovatis, villo densissimo omnino tectis, canescentibus.

Radice diffusa.

This is common with us in newly cleared rich meadow bottoms and spreads considerably. The other is more attached to woods. Ours I never met with in any remarkable degree hairy—and at first called it *scabriuscula* from its appearance occasioned by the dispersed hair on the nerves,

&c. The colour is an opake green on the upper side. It flowers in May and April. As usual I place the main diagnostics in contrast thus :

V. *pubescens.*	V. *eriocarpa.*
Caule simplici erecto, apice folioso.	= decumbente, ramoso, a basi folioso.
Foliis majoribus villoso-canescentibus.	= minoribus, scabriusculis.
Stipulis axillaribus: marcidis integris, villosis, minoribus.	= viridibus, magnis, semiamplexicaulibus valde ciliatis.
Nectario abrupte inflexo, acuminato.	= brevi vix producto, obtuso.
Capsulis glabris aut villosis, minoribus.	= dense villosis, magnis.

26. Species. V. *Striata.* Leconte and Nobis.
Non. V. *Striata* auctorum.

V. caulescens, glaberrima. *Caulibus* erectis, simplicibus, glaberrimis, superne angulatis, inferne teretiusculis ; apice tantum foliosis ; tota planta stricta.

Foliis glaberrimis, luteo-virescentibus ; pagina superiori splendore nitentibus, nervis crassiusculis quasi plicato-striatis ; forma plerumque lanceolato-lato-rhomboideis, quasi utrinque acuminatis, interdum hastato-cordatis, sinu apertissimo non rotundato ; statu juniori subcucullatis, eroso-dentatis.

Petiolis longitudine foliorum canaliculatis, demum cum folio reflexiusculis. Foliis ceterum alternis et in marginibus subciliatis. *Stipulis* axillaribus minoribus marcidis lato-ovatis, acutis, serratis.

Floribus luteis, extus saepe, praesertim in junioribus rubro tinctis, in *pedunculis* axillaribus erectis, apice minutim stipulatis, stipulis latioribus. *Petalis* subaequalibus majusculis; infimo rotundato, striato; lateralibus barbatis. *Nectario* non producto. *Calycis* laciniis glabris, lanceolatis, marginatis, subserratis, nervoso-striatis. *Stigmate* papillis obsito, lateribus barba alba ; in stylo breviusculo.

Capsulis minoribus glaberrimis. *Radice* fasciculari diffusa.

The erect, shining, and strict habit, the diamond shaped, strongly striate leaves, distinguish this Species easily. It grows from six to eight inches high before the stem puts out leaves, and then supports at most three, with a few axillary flowers. I have always found it growing single, though often in considerable numbers, in open woods on hill sides. Mr. Leconte first found it in our vicinity and directed my attention to it, and by continued observation I am well assured of its being a very good and constant species. Specimens have been sent from Cherokee country, agreeing

altogether with ours; I am pretty sure it has not been observed before; at least not distinctly. In a very few instances hairs were scattered on the nerves of the underside of young leaves; otherwise the glabrosity is very constant. It usually flowers before the leaves have fully expanded; middle of April and beginning of May is its time.

27. Species. V. *hastata*. Michaux.

Persoon, Synops. p. 255. n. 24. *Elliott*, p. 302. n. 13.
Michaux, p. 149. *Nuttall*, p. 150. n. 17.
Pursch, p. 174. n. 19. *Muhl.* Cat. n. 19. by Specimens.

V. caulescens; glabriuscula. *Caule* simplici, summitate tantum folioso, debili, saepe attenuato deorsum, erectiusculo. glabro, subangulato aut tereti; interdum purpurascenti.

Foliis alternis, lanceolato-hastatis, longe acuminatis, lobis obtusis eroso-dentatis, in lanceolata parte, dentibus distantibus; nervis ex fundo emanentibus, in pagina superiori pilis minutis adspersis; foliis ceterum glabris pagina inferiori, autem glaucis et purpureo tinctis. *Petiolis* brevissimis. *Stipulis* axillaribus minutis, ovato-acuminatis, ciliatis.

Floribus luteis, extus purpurascentibus, horizontaliter in pedunculis axillaribus, filiformibus, brevioribus foliis, stipulis alternis minutissimis. *Petalo* infimo dilatato, subtrifido, basi nigro striato, striis ramosis: Lateralibus, striis paucis; barba parcissima: in superioribus rudimenta striarum. *Calycis* laciniis lineari-lanceolatis, longiusculis, attenuatis, subdentatis. *Nectario* non producto. *Stigmate* truncato, lateribus fasciculatim piloso. *Capsulis* glabris. *Radice* horizontali, corallino-squamosa, bulbosa.

A very handsomely distinguished kind, very common here in May in shady places and among rotten wood on steep hill sides. The stem is weak and therefore often inclining. The caulis very often enters deep into the loose soil in which it grows before it expands into the root. Generally five or six inches high. The leaves of almost all our specimens, present a most perfect exemplification of an hastate leaf. I am therefore surprised, that Mr. Nuttall remarks, "they are rarely hastate." Possibly he is acquainted with a variety in which this is the case.

This species is more generally than any of the rest, affected with the *Aecidium Violae*, which frequently prevents its developement.

28. Species. V. *Nuttalli.* Pursch.

Pursch, p. 174. n. 20. Nuttall, p. 151. n. 18.

Though entirely unacquainted with this species, found by Mr. Nuttall, to whose indefatigable labours the science is so deeply indebted, on the plains of Missouri, and the only Viola he observed there, I have no doubt of its being a distinct species; that gentleman's talents for correct discrimination being above praise. Botany, I conceive, owes fully as much to him for his excellent distinctions, as on account of the unsparing zeal with which he traverses our most inhospitable wilds, to augment our knowledge. It flowers in May and grows to the height of six inches; it is allied to the former by all appearance. Mr. Nuttall describes it thus:

V. caulescens, perennis, pubescens. *Caule* simplici, erecto, folioso.

Foliis lanceolato-ovatis, integris, semiunciam latis, acutis, nervosis opacis, in petiolum longum attenuatis, margine et nervis minutim pubescentibus. *Stipulis* axillaribus longis, lanceolato-linearibus, integris. Folio cum petiolo 3--4 unciali, vix semiunciam lato.

Floribus minoribus, luteis, extus purpurascentibus, in *pedunculis* longitudine foliorum. *Calycis* laciniis lineari-lanceolatis acutis. *Stigmate* capitato, glabriusculo, erostrato.

The description seems to imply a considerable affinity to our V. *striata*.

The next species is the only American one of the subdivision *Stipulis pinnatifidis;* most of the European ones are alpine.

29. Species. V. *bicolor* vel potius *tenella.* Muhlenberg.

Elliott arvensis p. 302. n. 15. *Pursch bicolor* p. 175. n. 22.
Nuttall bicolor p. 151. n. 19. *Muhl.* Cat. *arvensis* n. 20. by specimens.
New-York Cat. *bicolor* n. 12. Muhl Cat. *tenella* n. 23. by imperfect specimens, and confirmed by the citation in New-York Catal. Rafinesque.

This interesting Viola grows with us, along the river bottoms and in retired mountain vallies in such a manner as to leave no doubt, that it is a true native. But from my knowledge of what the German botanists call *bicolor*, I cannot believe this plant the same, and have therefore preferred the name *tenella*, which Muhlenberg gave to some young specimens, I presume. The appearance of ours is indeed very different, early in spring, when it first begins to blossom, from what it assumes at a later period. It appears in March, and is then overloaded with rotundate-spathulate leaves arising from the root and low stem--and

this is nearly hid by the very large pinnatifid stipules. In time it grows very high, and but few of the radical leaves remain. The first flowers are larger in proportion than the later ones, and on short peduncles.

V. caulescens, glabriuscula. *Caule* triquetro, anguloso, erecto, simpliciusculo, folioso.

Foliis radicalibus, rotundato-spathulatis glabris, subdenticulatis: superioribus et secundariis lanceolato-spathulatis aut ovatis, breviter petiolatis. *Stipulis* oppositis, in medio et summo caule maximis, cristato-palmato-pinnatifidis, lobis multis, medio lobo longiori, ceteris lineari-oblongis obtusiusculis—in parte inferiori caulis stipulis minoribus. Omnibus margine ciliatis.

Floribus minoribus ex albo-coerulescentibus, in *pedunculis* longis angulosis sulcatis, glaberrimis axillaribus. *Petalo* infimo basi lutescenti, non barbato, venis simplicibus, paucis, coeruleis. Lateralibus exalbido-coeruleis, barba rigida alba. Superioribus nudis. *Nectario* parum postice porrecto. *Calycis* laciniis postice rotundato-auriculatis, ciliatis, antice lanceolatis. *Stylo* brevi. *Stigmate* clavato-turbinato, foramine urceolato, subpubescente. *Capsulis* ovato-globosis, glaberrimis, albis. *Radice* filiformi longa.

C. *Viola Anomala.*

The only remaining species is altogether so different in habit from the rest, that it assuredly ought to form a distinct Genus, to which probably some of the tropical ones belong. It does not grow in our vicinity; although it may be found in our mountains, as Mr. Elliott states. Mr. Nuttall has observed it in Upper Louisiana. My specimens are from Bethlehem, Pennsylvania.

30. Species. V. *concolor.* Muhlenberg. Forster.
Forster in Linn. Trans. 6. p. 309. T. 28. *Pursch.* p. 175. n. 21.
Nuttall p. 151. n. 20. *Elliott* p. 303. n. 16. *Muhl.* Cat. n. 22.

V. caule herbaceo erecto, undique folioso, angulato, simplici, piloso-scabro, pedali.

Foliis erectis numerosis, alternis, sessilibus, cuneato-lanceolatis, utrinque attenuatis, longe acuminatis, pubescentibus, margine irregulariter dentato, valde ciliato. *Nervis* alternis aut irregularibus. *Stipulis* axillaribus minutis subulatis.

Floribus minutissimis viridibus, in *pedunculis* axillaribus brevissimis, bi vel trifloris. *Petalis* emarginatis aequalibus,

calycem vix excedentibus. *Cornu* nullo. *Calycis* laciniis postice porrectis acutis, antice divergentibus lanceolatis.

Capsulis maximis oblongis glabris.

The habit of this plant resembles the Triosteum much more than any of our Violae. The stem is from one to two feet high, rather bending.

I conclude with a Synoptic table of all our Violae in order to facilitate their examination. Traces of a few others not sufficiently examined lead me to believe, that there are still a number of species in America undescribed.

A. Violae acaules.

* *Floribus papilionaceis, coerulescentibus, majoribus.*

a. Foliis multipartitis.

1. V. *Pedata.* *Foliis* pedatis, multipartitis.

b. Foliis heterophyllis, i. e. integris et divisis: plus minusve pilosis.

2. V. *palmata.* *Foliis* integr. raris, palmat. plur. nullis cucull. *Stipul.* integr. *Scap.* longitud. folior. *Petalo inf.* imberbi. *Stigm.* depres. marg. *Caesp.* paucifolios.
3. V. *asarifolia.* *Foliis* integr. plurim. palmat. raris, cucullatis. *Stipul.* divisis. *Scap.* brevioribus fol. *Petalo inf.* barbato. *Stigm.* globos. immarg. *Caesp.* foliosissim.
4. V. *sagittata.* *Foliis* integr. lanceol. cord.; secundariis oblongis, basi sagittato-dentatis incisis.
5. V. *triloba* N. *Foliis* integr. alteris reniformibus planiusculis, alteris trilobis.

c. Foliis omnibus indivisis.

6. V. *ovata.* Pubesc. undiq. *Fol.* ovatis. in petiol. decurrentib. erectis.
7. V *cucullata.* Glaberrim. undiq. *Fol.* cord. cucull. *Stipul.* minor. linear. *Scap.* teretibus. *Petal. inf.* rotundat. barbat. *Barb. later.* magn. cylindrica.
8. V. *obliqua.* Glaberrim. *Fol.* cord. cucull. *Stipul.* majorib. lanceol. *Scap.* quadratis. *Petal. inf.* limbo acum. carin. imberb. *Barb. later.* brev. clavato-globosa.
9. V. *villosa.* Pubesc. pag. sup. *Fol.* tenuior. planis, cord. renif. venis variegat. purpurasc. *Petal. inf.* nudo. *Calyce* postice auricul. *Petiol.* glabr.

† 10. V. *cordifolia.* Subpubes. pag. sup. *Fol.* crassis: *sinu* rotundat. clauso. non variegat. *Petal. inf.* barbato. *Calyce* non product. *Petiol.* glabr.

†† 11. V. *rotundifolia.* *Florib.* lutescent. *Fol.* glabris, orbicul. sin. claus. *Petiolis* pilosis.

** *Floribus, regularioribus, albescentibus, minoribus.*

† 12. V. *lanceolata.* *Foliis* erect. angustis, lanceolat, basi attenuatis, glabris. *Petiolis* glabris marginat.

13. V. *primulaefolia.* *Foliis* erect. oblong. subcordat. obtus. in petiol. decurrent; pilociuscul. *Petiolis* subtus pilos. rubicundis.

14. V. *blanda.* *Foliis* planis, terrae adpress. lato-cordatis. et orbiculat. *Sinu* clauso rotund. *Petiolis* longiorib. *Flor.* albis elatis in pedun. long.

† 15. V. *clandestina.* *Foliis* planis, caespitose aggregat. lato-cordat. acuminat. *Sinu* clauso rotund. *Petiolis* brevissimis. *Flor.* chocolatis subterran. in pedun. brev.

B. Violae caulescentes.

* *Stipulis axillaribus indivisis.*

a. Floribus coerulescentibus. Fol. glabriusculis.

† 16. V. *punctata* N. pag. sup. pilis minut. *Fol.* cordat. crassis glandulos. punctat. *Caule* brevi unifloro. *Nectar.* longo rostr. recurvo term.

17. V. *canadensis.* Pag. sup. pilis raris. *Fol.* cord. longe acumin. tenuib. luteo-virid. *Petalis* long. angustat. *Nectar.* brevi. vix product.

† 18. V. *uliginosa.* Glabriuscula. *Fol.* cord. acuminat. *Petiolis* brevib. *Pedunc.* filiform. longit. folior. *Nectar.* brevissimo non porrect.

19. V. *debilis.* Glaberrima. *Fol.* renifor. cordat. obtus. *Petiolis* longiusc. *Pedunc.* longiorib. foliis. *Nectar.* longo porrect. attenuato.

† 20. V. *rostrata.* Glaberrima. *Fol.* cordat. acutis. *Petiolis* mediocr. *Pedunc.* duplo long. foliis. *Nectar.* longissimo rostrat. duplo coroll. exced.

b. Floribus lutescentibus. Fol. pilosiuscul. plerumque.

21. V. *ochroleuca* N. Glabriuscula. *Caule* folioso erecto ramos. *Foliis* cordatis obtus. *Stipulis* maxim. marg. dentibus distant. *Flor.* ochroleuc. *barb.* concolore.

22. V. *repens* N. Glabriuscula. *Caule* decumb. stolonifer. ramos. *Foliis* reniform. minor. *Stipulis* mag. longissime ciliatis. *Flor.* minorib. *barb.* alba.

23. V. *tripartita.* Pubescens. *Caule* simplic. erect. apice folios. *Foliis* tripartitis. *Stipulis* n.

24. V. *pubescens.* Villoso-pubesc. *Caule* simplic. erect. apice folios. *Foliis* lato-cord. acuminat. *Stipulis* marcid. villos. integr. *Nectario* abrupt. inflex. acuto.

25. V. *eriocarpa* N. Scabriuscul. *Caule* decumb. ramos. folios. *Foliis* cordat. et reniform. *Stipulis* viridib. glabr. semiamplex. valde ciliat. *Nectario* obtuso vix producto.

26. V. *striata* N. Glaberrima. *Caule* simpl. erect. apice folios. *Foliis* rhomboideo-lanceolat. splendent. *Stipulis* minorib. lato-ovatis. *Nectario* non producto.

27. V. *hastata.* Pag. sup. minut. pub. *Caule* simpl. erect. apice folios. *Foliis* hastatis, basi dentat. oblongo-acuminat.

†† 28. V. *Nuttalli.* Pag. sup. minut. pub. *Caule* simpl. erect. apice folios. *Foliis* lanceolatis, ovatis, in petiolos attenuat.

** *Stipulis axillaribus, pinnatifidis.*

29. V. *tenella.* Glabra. *Stipulis* cristato-pinnatifidis. *Flor.* albo-coeruleis.

C. Viola anomala.

† 30. V. *concolor.* Pubescens. *Foliis* in caule alto undique sessilibus, utrinque attenuatis. *Peduncul.* minutiss. trifloris. *Flor.* minut. viridibus.

† Signifies that I have only seen dry specimens. †† that I have never seen the plant at all. Those not marked I have examined in a fresh state.

MATHEMATICS.

Art. XI.—*On Maxima and Minima of Functions of two variable quantities; by* A. M. Fisher, *Prof. Math. and Nat. Phil. in Yale College.*

[From the MSS. of the Connecticut Academy.]

Some of the most interesting as well as difficult cases of Maxima and Minima are those, in which a function of two variable quantities, x and y, is required to become the greatest or least possible, whilst another function of those quantities is supposed constant. Let the former of these functions, for the sake of brevity, be denoted by u and the latter by v. The ordinary method of solving problems of this description is by reducing the two equations, $\frac{du}{dx}dx+\frac{du}{dy}dy=0$ and $\frac{dv}{dx}dx+\frac{dv}{dy}dy=0$. But as both x and y are in this method made variable, it may be difficult, and in some cases impossible, to make the substitutions necessary to reduce the two foregoing equations to one.—In most cases it is the *relation* which holds between x and y, when u becomes a maximum to a given value of v, that is wanted, rather than the absolute value of either of the quantities x or y, expressed in terms of v. It might seem that if x or y were made constant, and v were allowed to vary, yet by *dividing* u by v, and making the differential of the quotient $=0$, the required relation between x and y would be obtained. This method would indeed give the value of u when its ratio to v is the greatest or least possible to the given value of x or y; but as the fraction $\frac{u}{v}$ will vary not only by a change in the ratio of x to y, but in that of u to v when $\frac{x}{y}$ is constant, the result obtained would be false. If, however u become some simple function of v, or vary as φv, when $\frac{x}{y}$ is constant, the true relation of x to y may be obtained by a method which admits of x or y being made constant. This consists in making, not $\frac{u}{v}$, but $\frac{u}{\varphi v}$ a maximum or minimum. If this be done, as $\frac{u}{\varphi v}$ can vary only from the

variation of x in regard to y, $\mathrm{d}\left(\frac{u}{\phi v}\right)$ taken in respect to *one* of the variable quantities x and y, and made $=0$, will give the same relation between x and y as if v were made constant, and x and y were both allowed to vary.

This result is concisely expressed in the following

THEOREM.

If u and v be any functions of x and y, and u become any any simple function of v, (that is, vary as v^n, $\log v.$, a^v, &c.) when $\frac{x}{y}$ is supposed constant, either of the equations $\frac{\mathrm{d}\left(\frac{u}{\phi v}\right)}{\mathrm{d}x}=0$, or $\frac{\mathrm{d}\left(\frac{u}{\phi v}\right)}{\mathrm{d}y}=0$, gives u a maximum or minimum to a given value of v.

The utility of this theorem will chiefly appear in the solution of Isoperimetrical problems. If x and y be the variable quantities in the equation by which the species of any geometrical figure* is expressed, and $\frac{x}{y}$ be supposed constant, while the arbitrary constant in the equation is made to vary, the figure will continue *similar* to itself; and there fore if v and u be either of the quantities compared in iso perimetrical problems, ϕv will become v^n, and $u \propto v^n$. If u be the length of a curvilinear figure, or a line drawn in or about it in any given manner, and v the area of the same figure, $n=\frac{1}{2}$: if u be a solid, and v be the whole or any constant part of its superficies, $n=\frac{3}{2}$: if v and u be both solids, superficies, or lines, $n=1$, &c.

* Those figures only are intended, which are capable of being defined by one arbitrary constant quantity, in addition to the two variable ones x and y. If the figure be a curve whose absciss and ordinate are x and y, and into the equation of which more arbitrary constant quantities than one necessarily enter, as is the case in most curves of the higher orders, different curves may be constructed to the same absciss and ordinate, merely by varying the relation of those constant quantities; so that although $\frac{x}{y}$ be supposed constant, the curve does not necessarily continue similar to itself. But the straight line, the circle, the parabolas, and the hyperbolas when referred to their asymptotes, are included in the first class, together with most of the other curves, both algebraic and transcendental, which are the most interesting in their properties, and have received particular names. The same thing is true of their superficies and solids of revolution.

The equation $\frac{d\left(\frac{u}{v^n}\right)}{dx}=0$ may, according to the common rules for maxima and minima, be thrown into the form $\frac{d\left(\frac{u^n}{v}\right)}{dx}=0$, or, if n be a fraction, and $=\frac{p}{q}$, $\frac{d\left(\frac{u^q}{v^p}\right)}{dx}=0$. The same is true of the equation $\frac{d\left(\frac{u}{v^n}\right)}{dy}=o$. Either of these forms may be used in individual cases, as is most convenient.

The following problems, which chiefly respect isoperimeters, will be sufficient to exemplify, and to shew the advantages of this method. To avoid confusion, the variable quantity x or y which is considered constant, will be put, during the operation, $=a$.

Prob. I.

Having given the solidity of a cone, to determine when the curve surface is a minimum.

In this case the height of the cone $=x$, and the radius of the base $=y$. Let the latter be constant and $=a$. The function $v=\frac{1}{3}\pi ax$, or varies as x, and $u=\pi a\sqrt{a^2+x^2}$, or varies as $\sqrt{a^2+x^2}$. Since $n=\frac{2}{3}$, $\frac{\sqrt{a^2+x^2}}{x^{\frac{2}{3}}}$, or $\frac{a^2+x^2}{x^{\frac{4}{3}}}$ $=$min. Making the differential of this fraction $=0$, x is found $=a\sqrt{2}$, whence $\frac{x}{y}=\sqrt{2}$.

Prob. II.

Having given the whole surface of a cone, to determine when the solidity is a maximum.

In this problem, v varies as $\sqrt{a^2+x^2}+a$; and u is as x. Also $n=\frac{3}{2}$, hence $\frac{x^{\frac{2}{3}}}{\sqrt{a^2+x^2}+a}=$max. which gives $\frac{x}{y}=2\sqrt{2}$.

Prob. III.

The whole surface of a regular prism being given, to find when the solidity is a maximum.

Let x be the height, as before, and y the radius of a circle inscribed in the base, which put const. and $=a$. If m be the number of sides, and t the tang. $\frac{180^\circ}{m}$, $2mat$ will be the sum of the areas of the ends, and $2mtx$ of those of the sides; hence $v=2nt\,(a+x)$, or varies as $a+x$. Also u is as x, and $n=\frac{3}{2}$; so that $\frac{x}{(a+x)^{\frac{3}{2}}}$ or $\frac{x^{\frac{2}{3}}}{a+x}=\text{max.}$ which gives $\frac{x}{y}=2$. The same expression will be obtained for the maximum solidity of a cylinder, whose surface is given.

By proceeding in the same manner, it will be found that where either the slant surface, or the whole surface of a regular pyramid is given, the solidity will be a maximum when that of the inscribed cone is a maximum; that is, when the radius of the circle inscribed in the base is to the height, in the first case, as $1:\sqrt{2}$, and in the last as $1:2\sqrt{2}$.

PROB. IV.

The sum of the radius (or diameter) of the base and the height of a cone being given, to find when the solidity is a maximum, and the whole surface a minimum.

Let a denote the radius (or diameter) of the base, and x the height: then $v=a+x$, and u is as x. In this case, $n=3$; hence $\frac{x}{(a+x)^3}$, or $\frac{x^{\frac{1}{3}}}{a+x}=\text{max.}$ from which $\frac{x}{y}=\frac{1}{2}$. For the superficies, which varies as $\sqrt{a^2+x^2}+a$, $n=2$; hence $\frac{\sqrt{a^2+x^2}+a}{(a+x)^2}=\text{min.}$ which gives $\frac{ax-x^2}{2a}=a+\sqrt{a^2+x^2}$, and by reduction $x^3-2ax^2+a^2x-4a^3=0$; whence the relation of x to y may be found.

If the perimeter of the vertical triangular section, or its half, the sum of the radius of the base and slant height, had been given, v would have been $=a+\sqrt{a^2+x^2}$, and for a maximum solidity, $n=3$, hence $\frac{x^{\frac{1}{3}}}{a+\sqrt{a^2+x^2}}=\text{max.}$ and $\frac{x}{y}=\frac{\sqrt{5}}{2}$.

Prob. V.

The solidity of a cone being given, to determine when the inscribed sphere is a maximum.

A sphere inscribed in a cone will have the same radius with that of a circle inscribed in its vertical triangular section. But the radius of a circle inscribed in an isosceles triangle, if a denote half the base and x the height, $=\frac{ax}{a+\sqrt{a^2+x^2}}$. Since the sphere is a maximum when its radius is such, u may be taken equal to this radius, if n is made $=\frac{1}{3}$. Since then v, the solidity, varies as x, we have to make $\frac{ax}{a+\sqrt{a^2+x^2}}\div x^{\frac{1}{3}}$, or $\frac{x^{\frac{2}{3}}}{a+\sqrt{a^2+x^2}}=$ max. By taking the differential coefficient $=0$, $\frac{2}{3}x^{-\frac{1}{3}}\,(a+\sqrt{a^2+x^2})$ $=\frac{x^{\frac{5}{3}}}{\sqrt{a^2+x^2}}$, or by reduction, $a\sqrt{a^2+x^2}=\frac{1}{2}x^2-a^2$, whence $x=a.2\sqrt{2}$.

By substitution, the rad. of the inscribed sphere $=\frac{a}{\sqrt{2}}$, and the diameter of the sphere appears to be a third proportional to the diameter of the base, and the height of the cone. The content of the sphere is $\frac{4}{3}\pi\frac{a^3}{\sqrt{8}}$ and that of the cone is $\frac{1}{3}\pi a^3\sqrt{8}$; hence when the sphere is a maximum, the cone is double the sphere.

The foregoing may suffice as a specimen of the application of this method to problems respecting lines of the first order.

Prob. VI.

The area of the parabola, between the curve and a double ordinate, being given, it is required to find the relation of the absciss and ordinate, when the inscribed circle is a maximum.

Let the absciss x be made constant and $=a$; put the ordinate, as usual, $=y$; then the radius of the inscribed circle is easily determined, by a figure drawn for the purpose,

to be $=y-\frac{y^2}{2a}$; or it varies as $2ay-y^2$. Let this be made $=u$; v, the area, varies as y, and $n=\frac{1}{2}$; hence $2ay^{\frac{1}{2}}-y^{\frac{3}{2}}$ $=$max. which gives $a=\frac{3}{2}y$, and the radius, by substitution. $=\frac{4}{9}a$.

Prob. VII.

The solidity of a paraboloid being supposed constant, to determine when the inscribed sphere is a maximum.

The radius of the inscribed sphere is the same with that of the circle inscribed in the generating parabola. u being again made $=2ay-y^2$, since $n=\frac{1}{3}$, and the solidity v varies as y^2, $\frac{2ay-y^2}{y^{\frac{2}{3}}}$ or $2ay^{\frac{1}{3}}-y^{\frac{4}{3}}$ must be made a maximum. Putting the differential coefficient $=0$, $a=2y$, or the axis of the paraboloid is equal to its double ordinate. The radius is $=\frac{3}{8}$ of the axis.

Prob. VIII.

Having given the curve superficies of a paraboloid, to find when the solid content is a maximum.

In this case it will be most convenient to consider the simple variable quantities on which the functions u and v depend as being the absciss and parameter. Making the parameter constant and $=a$, the surface v will be as $\overline{a^2+4ax}|^{\frac{3}{2}}-a^3$; the solidity u $(=\frac{1}{2}\pi ax^2)$ is as x^2 and $n=\frac{3}{2}$. Hence $\frac{u}{v^{\frac{3}{2}}}$ or $\frac{u^{\frac{2}{3}}}{v}$ that is, $\frac{x^{\frac{4}{3}}}{\overline{a^2+4ax}|^{\frac{3}{2}}-a^3}=$ max. whence $x^2-\frac{15}{4}ax+3a^2=0$, or $x=\frac{8a}{5\pm\sqrt{\frac{11}{3}}}$.

If we had taken the other formula $\frac{d\left(\frac{u^{\frac{2}{3}}}{v}\right)}{dy}=0$, making the absciss constant and $=a$, u is as y, and v as $\frac{\overline{4ay+y^2}|^{\frac{3}{2}}-y^3}{y}$; n, as before $=\frac{3}{2}$; hence $\overline{4ay+y^2}|^{\frac{3}{2}}y^{-\frac{5}{3}}-y^{\frac{4}{3}}=$ max. which gives $a^2-\frac{15}{4}ya+3y^2=o$. This equation exhibits the same relation between the absciss and parameter with the last.

If we attempt to solve this problem in the usual way, by making $\frac{\overline{4xy+y^2}|^{\frac{3}{2}}-y^3}{y}$ constant and $=b$, we obtain, after a tedious process, two equations between x and y, one of which is a quadratic in regard to y, and the other a cubic in regard to both to x and y. This appears to be the simplest form to which the solution, if it may be called such, can be brought, and it is only by an artifice not very obvious, that even this degree of simplicity can be attained.

The converse of this problem may, however, be readily solved in the usual manner, in consequence of the simplicity of the expression for the solidity. If with a given solidity, the superficies be required to become a minimum, since the solidity varies as x^2y, (x being as before, the absciss, and y the parameter,) put $x^2y=b^2$; then $x=\frac{b}{y^{\frac{1}{2}}}$, and by substitution in the expression for the surface, $\overline{4by^{\frac{1}{2}}+y^2}|^{\frac{3}{2}}y^{-1}-y^2$ $=$min., which by putting z in the place of $y^{\frac{3}{2}}$, affords the following equation: $3z^2-\frac{15}{4}zb+b^2=o$. This equation is of the same form with those already obtained, and it is evident that the same relation ought to exist between z $(=y^{\frac{3}{2}})$ and b, $(=xy^{\frac{1}{2}})$, as between y and x.

But the method adopted above is equally applicable to cases when both the functions u and v are complex, as will appear in the following problems.

Prob. IX.

It is required to determine when a parabola of given length will describe the greatest possible superficies by its revolution about its absciss.

In this example, v denoting the length and u the superficies, (the parameter being made constant and $=2a$,) $\frac{u}{v^2}=$ max. or, which is the same thing, $vu^{-\frac{1}{2}}=$min. Substituting the normal x $(=\sqrt{y^2+a^2})$, in place of y in the ordinary expressions for the length and superficies, the former will be found to vary as $x\sqrt{x^2-a^2}+a^2$ h.l. $\frac{x+\sqrt{x^2-a^2}}{a}$;

and the latter as x^3-a^3. Hence we have to make $\left(x\sqrt{x^2-a^2}+a^2\text{h.l.}\,\frac{x+\sqrt{x^2-a^2}}{a}\right)(x^3-a^3)^{-\frac{1}{2}}=$ min. which gives the following equation, expressing the relation between x and a: $\frac{x^3-a^3}{\sqrt{x^2-a^2}}=3a^2.\,\text{h.l.}\frac{x+\sqrt{x^2-a^2}}{a}$; or by restoring y; $\overline{y^2+a^2}|^{\frac{3}{2}}-a^3=3a^2y\,\text{h.l.}\frac{y+\sqrt{a^2+y^2}}{a}$.

Prob. X.

Having given the length of a parabola, it is required to find when the area contained by it and a double ordinate is a maximum.

Here v (putting the double ordinate $=2y$, and the parameter $=2a$) $=\frac{y}{a}\sqrt{y^2+a^2}+a\,\text{h.l.}\frac{y+\sqrt{y^2+a^2}}{a}$, and $u=\frac{2y^3}{3a}$, or varies as y^3. Hence, as $\frac{u}{v^2}=$ max., or $\frac{v}{u^{\frac{1}{2}}}=$ min., $y^{-\frac{1}{2}}\sqrt{y^2+a^2}+a^2y^{-\frac{3}{2}}.\,\text{h.l.}\frac{y+\sqrt{y^2+a^2}}{a}=$ min. whence $y\sqrt{y^2+a^2}=3a^2\text{h.l.}\frac{y+\sqrt{y^2+a^2}}{a}$. This equation will be more conveniently computed by approximation, if a be assumed $=1$. Or if φ be the arc, whose cot. $=\frac{y}{a}$, the value of y may be approximated by means of tables of natural and logarithmic sines, from the following equation: $\frac{\text{cot.}\,\varphi}{\text{sin.}\,\varphi}=3\text{h.l.cot.}\,\frac{1}{2}\varphi$. Or if COT. denote a tabular artificial cotangent, and m the modulus of the common system, $\frac{\text{cot.}\,\varphi}{\text{sin.}\,\varphi}=\frac{3}{m}(\text{COT.}\,\frac{1}{2}\varphi-10)$.

Cor. Since z, (the length of the curve,) $=\frac{y}{a}\sqrt{y^2+a^2}+a\,\text{h.l.}\,\frac{y+\sqrt{y^2+a^2}}{a}$, by substitution, $z=\frac{4}{3}\left(\frac{y^4}{a^2}+y^2\right)^{\frac{1}{2}}=\frac{4}{3}\sqrt{4x^2+y^2}$, ($x$ being the absciss,) when, with a given length, it contains the greatest area possible. The subtangent $=2x$; hence the length of the half of the curve, which lies above the axis, is $\frac{2}{3}$ that of the tangent.

Prob. XI.

It is required to suspend a flexible chain, of given length, in such a manner that the area, included by it, and the straight line joining its extremities may be the greatest possible.

The area of this curve, contained between the absciss x, the ordinate y and the curve z, is $=(a+x)y-az$. The equation of the curve is $z^2=2ax+x^2$; hence $a+x=\sqrt{a^2+z^2}$, and the area is $\sqrt{a^2+z^2}\,.\,y-az$ ($=u$.) If the area were supposed constant, a must be made to vary; but by making $\frac{u}{v^2}$ a maximum, or $\frac{y\sqrt{a^2+z^2}}{z^2}-\frac{a}{z}=\text{max.}$ a may be supposed constant. We might proceed to exterminate y, and to find the differential with one variable z, as in the preceding cases; but in the present case, it will be most convenient to retain y in finding the differential, and to exterminate it afterwards. The differential equation, considsidering y and z as both variable, is $-\frac{y(2a^2+z^2)\,dz}{z^3\sqrt{a^2+z^2}}+\frac{\sqrt{a^2+z^2}.dy}{z^2}+\frac{adz}{z^2}=0$. But $dy=\frac{adz}{\sqrt{a^2+z^2}}$; hence by substitution, (putting for y its equal ah.l.$\frac{z+\sqrt{a^2+z^2}}{a}$,) $\frac{2a^2+z^2}{\sqrt{a^2+z^2}}$ h.l. $\frac{z+\sqrt{a^2+z^2}}{a}=2z$. This equation may be thrown into the following form: $\frac{\frac{2a^2}{z^2}+1}{\sqrt{\frac{a^2}{z^2}+1}}$.h.l.$\frac{1+\sqrt{\frac{a^2}{z^2}+1}}{\frac{a}{z}}=2$.

Now $\frac{a}{z}=\frac{dy}{dx}=$tang. of the angle φ contained by a line drawn touching the upper extremity of the curve and the absciss produced; and $\sqrt{\frac{a^2}{z^2}+1}=$sec. of the same angle. Putting this secant$=s$, we have by substitution, $\frac{2s^2-1}{s}$.h.l.$\left(\frac{s+1}{\sqrt{s^2-1}}\right)=2$. But h.l.$\left(\frac{s+1}{\sqrt{s^2-1}}\right)=\frac{1}{2}$h.l.$\left(\frac{s+1}{s-1}\right)$; hence $\frac{2s^2-1}{s}$.h.l.

$\frac{s+1}{s-1}=4$. This equation may be easily approximated: but if a table of sines and tangents be preferred, it may be transformed into the following: (sec. $\varphi-\frac{1}{2}$cos.φ) (cot.$\frac{1}{2}\varphi-10$) $=m$. From either of these equations, φ appears to be $=22°\ 42'\ 57''$. Hence the chain, when it includes a maximum area, must be so placed that the tangents to its two extremities shall make an angle of $45°\ 25'\ 54''$. And since $y=a.\text{h.l.}\frac{z+\sqrt{a^2+z^2}}{a}$, to find y in terms of z, first put $z=1$, and $y=a.\text{h.l.}\frac{1+\sqrt{1+a^2}}{a}$. When $z=1$, a ($=z$. tan. φ, because Vince's Flux. p. 38. subt. $=\frac{zy}{a}$)$=,4186338$; hence y will be found $=,773946$. Since y varies as z in similar figures, whatever z may be, the distance of the points of suspension must be to the length of the chain as ,773946 to 1.

Prob. XII.

To determine the form of a cup, which, with a given thickness and weight of materials, shall have the greatest possible capacity.

It is easily shewn that this cup must be some portion of a hollow sphere, terminated at the top by a plane. If the thickness be regarded as inconsiderable, with a given superficies, we have to make the solid content a maximum. Let y be the ordinate of the generating circular segment, and let the absciss x be made constant, and $=a$. Then the radius of the sphere $=\frac{x^2+a^2}{2a}$, the solidity is as $3x^2+a^2$, the superficies as x^2+a^2, and since $n=\frac{2}{3}$, $\frac{(3x^2+a^2)^{\frac{2}{3}}}{x^2+a^2}=$max. from which $x=a$; or the cup must be hemispherical.

Prob. XIII.

To determine the same thing, when the thickness of the vessel (supposed in the form of a spherical segment) is inconsiderable at the bottom, and varies in such a manner as

to render the vessel, so far as the pressure of a contained fluid is concerned, equally strong throughout.

The thickness, to verify this condition, must be every where as the distance from the top. If the ordinate be x, and the height a, as before, it is shewn without difficulty that the solid content of the vessel, or the space contained between the interior and exterior surfaces (putting t = thickness at bottom) is equal to $\pi ta \times$ rad. of the sphere. Now while the capacity of the vessel is supposed to continue similar to itself by making $\frac{x}{y}$ constant, t the thickness of the bottom, must be supposed constant, otherwise v, the space included between the two surfaces, will be a function of an arbitrary variable quantity, which does not enter into u, the capacity. But if t be constant, while the capacity varies so as to continue similar to itself, the thickness at any other point, which continues similarly situated with regard to the whole surface, will continue constant. Therefore while u continues similar to itself in all its dimensions, v varies only in two dimensions; so that $n = \frac{2}{3}$, as before, and the same result is obtained as in the last problem. The same would be true, should we suppose the thickness from the bottom upwards, to vary as any other function of two dimensions, into which x and y alone enter.

Schol. In two cases, the vessel, of which the outside is spherical, and the thickness every where as the distance from the top, will have its interior surface spherical. When it is a hemisphere, the interior surface will be a hemisphere of the *same radius*, and the thickness, estimated perpendicularly to the horizon, will be every where the same. When it is an entire sphere, the inner surface will also be an entire sphere, of a radius less than the exterior surface by half the thickness of the bottom; and the sum of the two thicknesses, contained in any one vertical line, and estimated in the direction of that line, will be every where the same.

Prob. XIV.

Having given the area of a circular sector, to find when its chord is a maximum.

In this case let the radius and half the arc be the simple variable quantities x and y: make the radius constant and $=a$; then the chord $=2a\sin y$, or varies as sin. y, and the sector varies as y. Since $n=2$, the fraction to be made a maximum is $\frac{y}{\sin^2 y}$. By taking the differential, $\sin y dy=2y$. $d(\sin y)$. But $d(\sin y)=\frac{\cos y dy}{a}$; hence by substitution and reduction, $\frac{a\sin y}{\cos y}=2y$. Or tang y, to rad. $a=2y$. Hence $y=66^\circ\ 46'\ 54''\frac{1}{4}$.

Prob. XV.

Having given the area of a circular sector, which is suspended by its vertex, and vibrates in its own plane, it is required to determine when the time of vibration is a minimum.

The notation remaining as before, the distance of the centre of gravity from the vertex of the sector$=\frac{2a\sin y}{3y}$; and that of the centre of oscillation is found without difficulty to be $=\frac{3ay}{4\sin y}$. The time of vibration varies as the square root of the line $\frac{3ay}{4\sin y}$, or as $\sqrt{\frac{y}{\sin y}}$. If the function u denote the time, and v the area of the sector, when $\frac{x}{y}$ is supposed constant, $u \propto v^{\frac{1}{4}}$, or $u=\frac{1}{4}$; hence $\frac{\sqrt{\frac{y}{\sin y}}}{y^{\frac{1}{4}}}$, or $\frac{y}{\sin^2 y}=$ min. which leads to the same result as in the last problem.

It will be unnecessary to add more examples in illustration of this method. If it furnishes no new instrument to the adept in Analysis, it may still perhaps be regarded with some interest by those who are desirous of giving the greatest possible extent to the ordinary method of obtaining maxima and minima, in consequence of not enjoying the opportunity of becoming familiar with all the refinements of the modern calculus.

Yale College, August, 1818.

PHYSICS AND CHEMISTRY, MECHANICS AND THE ARTS.

ART. XII.—*Correspondence between* ROBERT HARE, *M. D. Professor of Chemistry &c. in the Medical Department of the University of Pennsylvania, and the Editor, on the subject of* DR. HARE'S *Calorimotor and Deflagrator, and the phenomena produced by them.*

INTRODUCTORY REMARKS.

It may be remembered, by the readers of this Journal, that in the letter alluded to below by Dr. Hare, (see p. 201, vol. 4.) the editor, after relating the experiments which he had performed with the Deflagrator, states that he had discovered a very unexpected and surprising incompatibility between the Deflagrator and the common galvanic battery.—On connecting an instrument of the latter description, consisting of six hundred and twenty pairs, of four and six inch plates, in full activity, with the Deflagrator of eighty coils also in great power, both instruments were completely paralysed: this was constantly the fact however they were connected, but, on being separated, each instrument instantly recovered its energy. Dr. Hare's first letter relates to this subject.

LETTER 1.—From Dr. Hare, on the incompatibility of the above instruments, and the common galvanic Batteries when used in connexion.

Philadelphia, November 5, 1821.

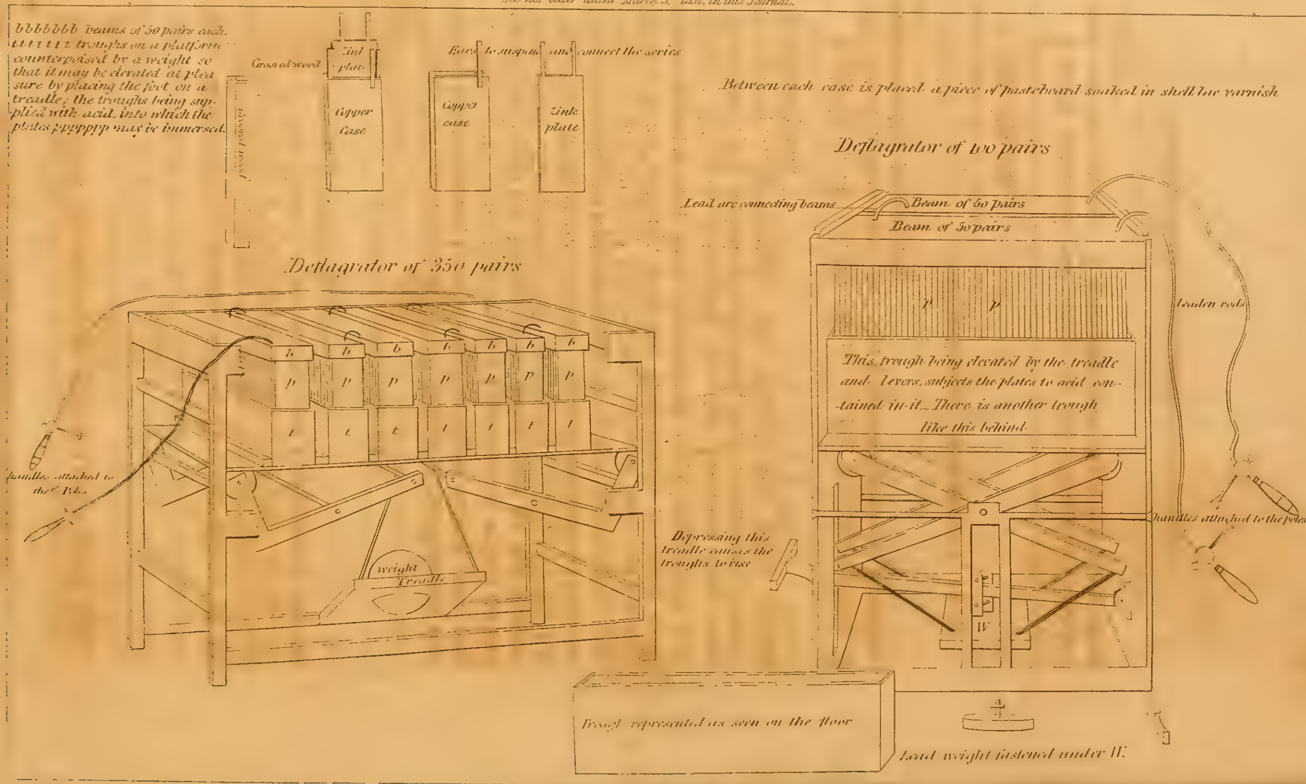
My Dear Sir,

I HAVE received your letter on the Deflagrator which I sent you last spring. I fear you have done me more than justice.*

* See No I. vol. IV. of this Journal, for October last.

DR. HARE'S NEW GALVANIC DEFLAGRATORS.

See his letter dated March 5th last, in this Journal.



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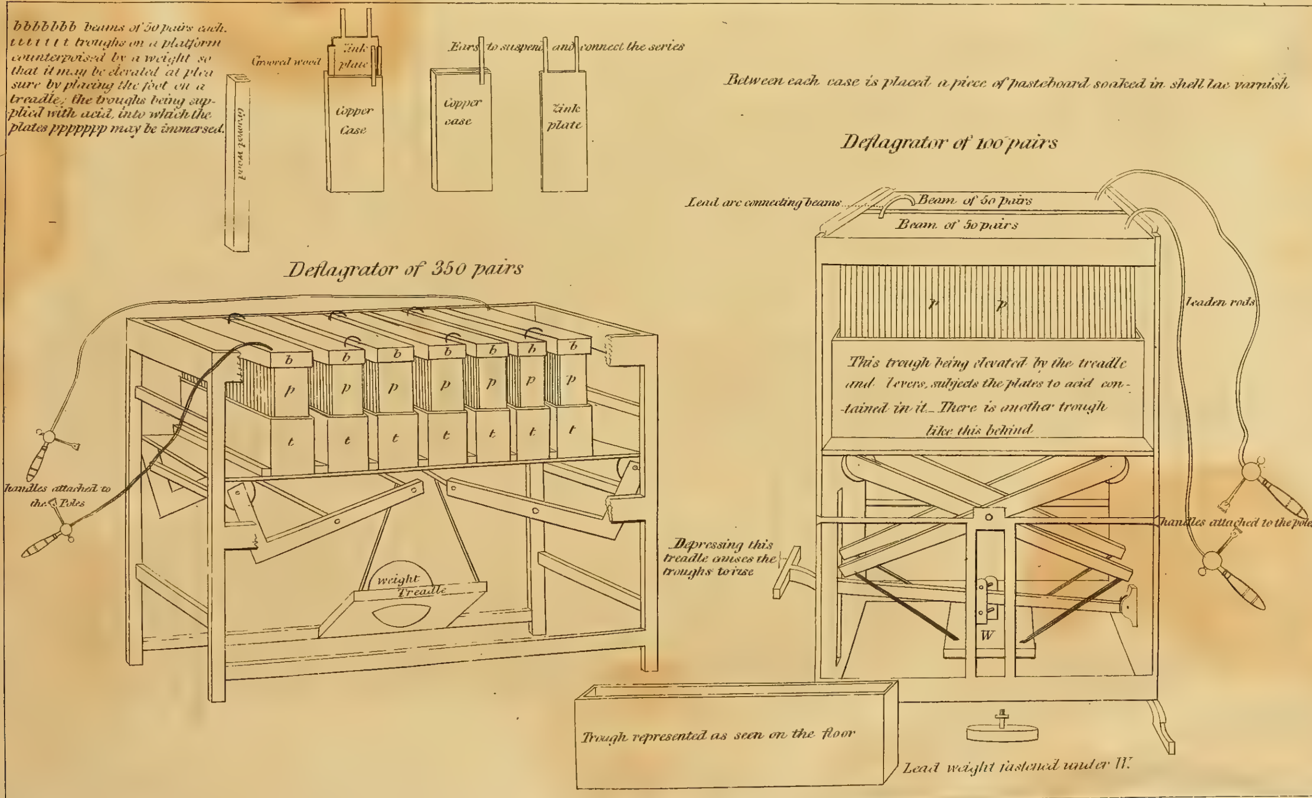


I should not be surprised, if the coils when insulated by the glass jars, should form a circuit with your other apparatus, better, than when immersed in the troughs. You will observe that when recently lifted from out of the acid, the air insulates the coils; while the pieces of wood used to keep the copper from touching the Zinc, act to a certain extent like the moistened cloth in Volta's original pile.—When in this situation, the poles will affect an electrometer much more powerfully, than when the coils are immersed; though in one case, the igniting power will burn a platina wire of one eigth of an inch in thickness, in the other it will not burn Dutch gold leaf.

In my memoir, on a new theory of galvanism, published in your Journal is the following passage: "According to my view, caloric and electricity may be distinguished by the following characteristics. The former permeates all matter more or less, though with very different degrees of facility. It radiates through air with immeasurable celerity, and distributing itself through the interior of bodies, communicates a reciprocally repellent power, to atoms, but not to masses.* Electricity does not radiate in or through any matter, and while it pervades some bodies, as metals, with almost infinite velocity; by others it is so far from being conducted, that it can pass through them only by a fracture or perforation. Distributing itself of choice over surfaces only,† it causes reaction between masses, but not between the particles of the same mass. The disposition of the last mentioned principle (electricity) to get off by neighbouring conductors, and of the other (caloric) to combine with the adjoining matter or to escape by radiation, would prevent them from being collected at the positive pole, if not in combination with each other. Were it not for a modification of their properties consequent to some such union, they could not, in piles of thousands of pairs, be carried forwards through the open air and moisture, the

* It cannot be pretended that electricity expands the gold leaves of an Electrometer when it renders them divergent, or that caloric causes any repulsion between the ignited masses which it expands.

† It is only when under a great restraint, that electricity enters the pores of metallic wires and deflagrates them. If it exist otherwise than on the surfaces of conductors, why does a hollow metallic sphere take as large a charge as a solid one.

one so well calculated to conduct away electricity, the other so favourable to the radiation of caloric."

Pursuing the same subject in a subsequent memoir, also published in your Journal I thus expressed myself, "As yet no adequate reasons have been given why, in operating with the pile, it is not necessary, as in the process of Van Marum and Wollaston, to enclose the wires in glass or sealing wax, in order to make the electricity emanate from a point within a conducting fluid. The absence of this necessity is accounted for, according to my hypothesis by the indisposition which the electric fluid has to quit the caloric in union with it, and the almost absolute incapacity which caloric has to pass through fluids unless by circulation. I conceive that in galvanic combinations, electro-caloric may circulate through the fluids from the positive to the negative surface, and through the metal from the negative to the positive. In the one case caloric subdues the disposition which electricity has to diffuse itself through fluids, and carries it into circulation. In the other, as metals are excellent conductors of caloric, the prodigious power which electricity has to pervade them agreeably to any attractions which it may exercise operates almost without restraint. This is fully exemplified in my galvanic deflagrator, where eighty pairs are suspended in two recipients, forty successively in each, and yet decompose potash with the utmost rapidity, and produce an almost intolerable sensation when excited only by fresh river water. I have already observed that the reason why galvanic apparatus composed of pairs consisting each of one copper and one zinc plate, have not acted well without insulation ; was because electro-caloric could retrocede in the negative, as well as advance in the positive direction."

Agreeably to these views, in order to prevent the escape of the electricity put into motion by the series, the caloric must bear a certain proportion to it. It is to be inferred, consistently with the same hypothesis, that this proportion did not exist in the series which you connected with the deflagrator. The fluid presented to the latter had too much electricity in it; and hence instead of passing into circulation, escaped. When the coils were suspended in air, this escape was less favored than when they were covered by the diluted acid. Faithfully Yours.

ROBERT HARE.

LETTER II.—From Dr. Hare, on the peculiar and comparative effects of the Calorimotor and Deflagrator. Also, an account of AN IMPROVED AND ENLARGED DEFLAGRATOR, and of some new experiments performed by means of this instrument.

Philadelphia, March 5, 1822.

My Dear Sir,

In reply to your enquiries on the subject of the Calorimotor, and the expediency of employing one during your lectures, it may be proper to mention, that the phenomena produced by it are more agreeable to the eye and therefore more popular, than any which can be performed without greater difficulty. By the time the Calorimotor is completely immerged in the acid solution, the wire in the forceps is rendered white hot, and takes fire, emitting the most brilliant sparks. In the interim, an explosion usually gives notice of the extrication of hydrogen in a quantity adequate to reach the burning wire. Immediately after the explosion, the hydrogen is reproduced with less intermixture of air, and rekindles, corruscating from among the forty interstices, and passing from one side of the machine to the other in opposite directions, and at various times, so that the combinations are innumerable. The flame assumes various hues, from the solution of more or less of the metals, and a blazing froth, rolls over the sides of the recipient. When the calorimotor is withdrawn from the acid solution, the surface appears for many seconds like a sheet of flaming foam.

I refer you to the last paragraph of my memoir on the Deflagrator, for some results obtained by calorimotors, of different sizes, which I deem to be scientifically important.*

* The heat evolved by one galvanic pair has been found by the experiments which I instituted, to increase in quantity, but to diminish in intensity, as the size of the surface may be enlarged. A pair containing about fifty square feet of each metal, will not fuse platina, nor deflagrate iron, however small may be the wire employed; for the heat produced in metallic wires is not improved by a reduction in their size beyond a certain point. Yet the metals abovementioned, are easily fused or deflagrated by small pairs, which

With respect to the comparative powers of concentric coils, of copper and zinc and of plates of those metals alternating; if only a few pairs are to be employed, I believe it a matter of indifference which construction we adopt. I have however, found to my cost that it is far from being so when the series is numerous. Last summer I constructed an apparatus of one hundred pairs, each containing six alternated plates, three of each metal. On trial, it proved much less powerful than the Deflagrator sent to you, though the zinc surface in each pair, was one seventh larger, and the number of the series one fourth more extensive. The exposure to each other, of the copper and zinc plates terminating the different pairs, struck me as disadvantageous. I therefore, removed the external zinc plate in each, so that the pair afterwards, consisted severally of three copper and two zinc plates, and were bounded by copper towards both poles. There was some comparative gain by this change, as the power was not lessened in proportion to the diminution of zinc surface. Still the result was unsatisfactory. I then had some boxes made with partitions of glass, to be interposed between the pairs of the series. These were employed as is usual with galvanic troughs, made with partitions, excepting the deficiency of bottoms, and their being suspended to the beams, so as to be simultaneously immersed with the galvanic surfaces which they were intended to insulate. The power of the series was not amended by this contrivance. It had often occured to me, that surrounding the zinc by Copper, might be an indispensable feature in the arrangement of my Deflagrator of coils. In order to test the correctness of this surmise, I proceeded to form an ap-

would have no perceptible influence on masses that might be sensibly ignited by larger pairs. These characteristics were fully demonstrated, not only by my own apparatus, but by those constructed by Messrs. Wetherill and Peale, and which were larger, but less capable of exciting intense ignition. Mr. Peale's apparatus contained nearly seventy square feet, Mr. Wetherill's nearly one hundred, in the form of concentric coils, yet neither could produce a heat above redness on the smallest wires. At my suggestion, Mr. Peale separated the two surfaces in his coils into four alternating, constituting two galvanic pairs in one recipient. Iron wire was then easily burned and platina fused by it. These facts, together with the incapacity of the calorific fluid extricated by the calorimotor to permeate charcoal, next to metals the best electrical conductor, must sanction the position I assigned to it as being in the opposite extreme from the columns of De Luc and Zamboni. For as in these, the phenomena are such as are characteristic of pure electricity, so in one very large galvanic pair, they almost exclusively demonstrate the agency of pure caloric.

paratus of pairs, each consisting of a case of copper, containing one zinc plate of seven inches by three, the size used, in the apparatus above described. (See the plate at the end.) In these pairs, as in those contrived by Wollaston, the edges of the zinc were supported by grooved pieces of wood passing between them and the copper. There was, however, this apparently slight, but really important difference, that the cases employed by me, were open at top and bottom, instead of exposing the edges of the zinc laterally, as in Wollaston's. One hundred galvanic pairs, thus made, were suspended to two beams, each holding fifty. Between each case, a piece of pasteboard soaked in shell lac varnish, was interposed; so that the whole constituted a compact mass, into which a fluid could not enter, unless through the interstices purposely preserved between the copper and zinc. The phenomena produced by this apparatus, on immersion, were upon the whole more interesting than those produced by my original deflagrator; especially in the length of the jet between the poles, and the power of permeating charcoal. Yet the apparatus was comprised within one eighth of the space, and is not (in oxidizable superficies) of half the extent.

Having added three more beams, of fifty pairs each, to my apparatus, I found the power increased fully in the ratio of the number. You know that my eyes are naturally very strong. The light produced by the compound blowpipe,* though I operated without glasses, only dazzled them for a time, and hitherto I had felt no other inconvenience from my galvanic experiments. Rendered thus bold by previous immunity, I still dispensed with the annoyance of spectacles. In consequence, my eyes, after operating with the last mentioned series of two hundred and fifty, were on the following day so much inflamed, as to be blood shot, and painfully susceptible of the day light. The judicious application of twenty leeches to each of the eye-lids, pursuant to the advice of my friend, Dr. Dewees, afforded me surprising relief, and my eyes are now well enough to finish this letter, though a few days since when I began it, I was under the necessity of employing an amanuensis.

By this series of 250, Barytes was deflagrated; and the Platina which supported it destroyed like pasteboard before

* Since called Hydro-oxygen Blowpipe.

an incandescent iron. A platina wire three sixteenths of an inch in thickness, was made to flow like water. Iron of like dimensions burned explosively. When the experiments were repeated before my class of more than three hundred pupils, and many visitors, there were very few who could bear the light with the naked eye.

Much attention was excited by the deflagration of a stream of Mercury. This was accomplished in the following way. A wire proceeding from one pole of the deflagrator, was introduced into some mercury held in a glass basin; and another wire proceeding from the other pole, into some mercury in another vessel, having a capillary orifice which might be closed by the finger or a stopple. This last mentioned vessel with the mercury running from it was supported at such a height above the surface of the mercury in the glass basin, as to permit the discharge to take place through the metallic stream just as the galvanic surfaces were subjected to the acid. The mercury deflagrated explosively.

The experiments may be varied, by causing the stream of mercury to fall on iron filings, or card teeth.

When the phenomena of a series of 250 pairs of 7 inches by 3, are such as I have described what would be the power of a deflagrator with plates, as large as Children's, and as numerous as Davy's?

Probably the most useful mode of applying such instruments to analysis, would be to expose substances to the discharge in vacuo on carbon. I observed that after iron and charcoal were ignited between the poles during a few seconds, under an exhausted receiver, on admitting the air, a flash took place, and a yellowish red fume appeared which condensed on the glass. It would seem the iron was volatilized,* and that the admission of air oxidized the vapour.

A deflagrator of 250 or 300 pairs is found to produce torture when applied for a short time to the back of the hand, and it is difficult for the sufferer to believe, that his skin has not been cauterized. One of my pupils showed me a slight excoriation, which he considered as arising from it, on the spot where the positive pole had touched him. Between the excitement of acid, and water, the difference of power in affecting the flesh, is far less than with metals,

* And possibly the carbon too? Ed.

charcoal, or potash. Upon these substances, the excitement by water has no influence, but to the sensation is painful, though it may be borne longer, than when acid is used. Neither is the shock greater, in any sensible degree, at the moment of immersion, than afterwards. The effect upon the electrometer, is at least as great, with water, as with acid. Immediately over any of the most turgid veins, where the skin is tender, as on the back of the hand, will be found the greatest sensibility. The positive pole, is most capable of producing pain. This I had frequent opportunities of ascertaining, by the observations of those who, not knowing how to distinguish it from the negative pole, could not have been biassed in their opinion. Upon a common gold leaf electrometer, a deflagrator of 300 pairs will have no influence. I have constructed one by means of a bottle, a single slip of gold leaf, and a knob at right angles to it, supported by a screw, so as to be easily moved nearer to or further from the leaf. The wire from which the latter is suspended, passes through a cork in the neck of the bottle. The screw enters through a nut, cemented into a hole drilled on one side. When the wire which supports the leaf, is fastened to one of the poles, every time the screw is touched by the other, the leaf will strike the ball provided the distance be very small, perhaps not greater than the tenth of an inch. This result was obtained at a greater distance when the coils had been recently withdrawn from the acid, than when they are covered by it. I have known a piece of dry sealing wax, as big as a chesnut, without friction, to affect this electrometer as much as my largest deflagrator.

A magnetic needle was very powerfully disturbed by the deflagrator, under all its forms. The celerity with which the galvanic surfaces may be immersed in, or withdrawn from the acid, contributes much to economy, and to the ease of the operator in galvano-magnetic enquiries.

The prevalent notion, that the intense light and heat produced by galvanic action, are results secondary to electricity, the presence of which is at times only indirectly discoverable, the more surprises me; since it does not in the smallest degree, elucidate the primary operation, by which this principle is alleged to be evolved. According to some philosophers, the contact of the metals alone, according to others this contact accompanied by their solution, evolves electricity in quantity sufficient to extricate heat

and light from a wire made the medium of transmission. They do not however, explain why the electricity does not, according to all its known habitudes, rapidly escape through the water, as fast as generated, instead of proceeding from one plate to another, in order to pass off through a second portion of the same fluid. Would it not be more philosophical, to suppose that the heat and light result *directly* from the causes supposed to produce them *indirectly*; especially, as we actually see *them* in a high degree of intensity, while the characteristic agency of the principle, by which they are supposed to be produced, is but feebly perceived, or imperfectly demonstrated? In the case of a single galvanic pair, electricity has never been alleged discoverable, unless by the questionable assistance of condensers.

Besides, without supposing caloric and light to circulate from the apparatus through the conjunctive wire, those who consider them as material, will find it impossible to account for the durability of the ignition. If it be supposed that these principles are extricated from the metal, only by electricity passing through it, their repeated or incessant expenditure, ought sooner or later to exhaust the metal, and render it incapable of further ignition.

On this subject, especially, as connected with magnetism, and mechanical electricity, you shall hear from me again.

LETTER III.—From the Editor.—On the incompatibility of the Voltaic Batteries and the instruments of Dr. Hare when used in connexion.

TO PROFESSOR HARE.

Yale-College, New-Haven, April 9th, 1822.

My dear Sir,

In my letter of Oct. 23d, 1821, addressed to you (Vol. 4, p. 203 of this Journal) respecting the experiments which I had performed with your deflagrator, I mentioned the incompatibility which I discovered to exist between your apparatus and the common galvanic battery. I have recently repeated these experiments with some additions and variations which I now take the liberty of stating to you.

In the trials made last October with your instrument, the coils were used without glasses, being immersed in a fluid, contained in a common recipient. In those recently performed, and which I shall now relate, the metallic coils were individually insulated, for they were immersed in the cylindrical glasses belonging to the apparatus, it being previously connected with the common galvanic battery by its proper poles as described in my former letter; the effects were however in no respect different from those before observed, so that the insulation of the coils appears to be a fact of no importance. In the first experiment the deflagrator being connected by its proper poles with a galvanic battery of 300 pairs of four inch plates cemented in mahogany troughs, and interposed between the two rows of the deflagrator, of forty coils each, lost all its power, and the effect produced was very much inferior to that of the battery alone, for in fact the spark was hardly perceptible.

The chemical or decomposing powers of the common galvanic battery, were also found to be suspended by the connexion—for the 300 pairs which usually decompose water, salts, &c. with decisive energy, now produced in water scarcely a bubble of gas, and hardly affected dilute infusion of purple cabbage. The power of giving a shock was also destroyed by the connexion.

When the coils were raised out of the fluid and suspended only in the air, they acted as conductors of the power of the common battery, which now produced *all* its appropriate effects, although, even in this case, the galvanic influence appeared somewhat diminished, which would of course arise both from *the extent* of the conducting surface, and from the fact that a part of the substance, namely, the wedges of moist wood, interposed between the metals was an imperfect conductor.

These experiments (including the former trials) were made with different combinations from 620 pairs down to 20, and were attended, uniformly with the same result; viz. an almost entire suspension of the power of both instruments.

In one of the experiments, twenty-five pairs of the zinc and copper plates, six inches square, connected by slips of copper and suspended from a beam of wood were immersed in a trough without partitions filled with an acid liquor, and the connexion being formed with the deflagrator, the

power of the latter instrument was found to be completely destroyed—a similar result was obtained by a battery consisting of fifty *triads* of plates two inches square, each zinc surface being coated by a copper plate after the manner of Dr. Wollaston—the object of this arrangement, was, to ascertain, whether a battery, in which the arrangement of metals was similar, to that in the deflagrator, would produce a result in any respect different from that of the common battery; the effect however was precisely the same. In most of the experiments the connexion of the poles was occasionally reversed. This circumstance however made no difference in the result; a feeble spark was obtained as before. Every thing tended to countenance the opinion *that the interposition of the common galvanic battery operated simply as an impediment—that it was completely inert in relation to the deflagrator, and the deflagrator in relation to it, —that the power of neither would pass through the other, and consequently that each was to be regarded, with respect to the other, simply as so much interposed matter, constituting a conductor more or less, imperfect.* To bring this conjecture to a decision, the number of interposed plates was constantly diminished, until the connexion was formed by no more than twenty pairs. In this state of things, the power of the deflagrator passed freely, although somewhat diminished. The connexion was now formed with smaller and smaller numbers of pairs; the activity of the deflagrator in the mean time rapidly increased, until the moment, when only one pair was employed (this pair being, however, like the others, immersed in an acid fluid,*) then there was no perceptible impediment, and the effect was as brilliant as when nothing was interposed.

I have thought these curious facts worthy of being preserved, and I have addressed them to you with the hope that you will be able to throw some light upon this singular anomaly, which to me appears to be incapable of explanation, in consistency with the received theories of galvanism. Hoping that you will, through the medium of this journal, favour the public with your views upon this subject.

I remain with very great respect,

Your friend and servant,

B. SILLIMAN.

* When this *one* pair was surrounded by air alone the power of the deflagrator passed freely as might have been expected.

Letter IV.—From Dr. Hare to the Editor in reply to the preceding letter.

Philadelphia, May 25, 1822.

My Dear Sir,

In a former letter you mentioned, that you had found the power of the galvanic deflagrator, when its coils were subjected to acid in troughs without partitions, incompatible with the power of other voltaic series, of the usual forms; that when associated with them in one circuit, it could neither give, nor receive excitement. You now inform me, that this incompatibility is not lessened when the coils are insulated by glass jars.* It follows, that electrical insulation has less influence on the action of this instrument, than I had supposed, and it of course confirms my idea, that the deflagrating power is not purely electrical.

It cannot be doubted, notwithstanding your experiments, that there is a principle of action, common to the various apparatus which you employed, and all other galvanic combinations. The effect of this principle of action however, varies widely according to the number of the series, the size of the members severally, and the energy of the agents interposed. Towards the different extremes of these varieties are De Luc's Column apparently producing pure electricity, and one large galvanic pair, or calorimotor of two surfaces, producing, in appearance, only pure caloric. At different points between these, are the series of Davy and Children; the one gigantic in size, the other in number. In the deflagrator we have another variety, which, with respect to size and number, is susceptible of endless variation.

It must be evident that no galvanic instrument, where a fluid is employed, could aid, or be aided by, the columns of De Luc or Zamboni. Nor could the influence of either be transmitted by the other. A calorimotor could not aid Davy's great series; nor could the latter, act through a calorimotor. Taking it for granted that there can be no oversight in your experiments, this incompatibility of ex-

* See Memoir and engraving in this Journal for February, 1821. Also, in Tilloch's magazine, and the Annals of Philosophy, for April and May, 1821.

citing power must exist to a great degree, under circumstances where it could hardly have been anticipated.

Were the fluid evolved by galvanic action purely electric, the effect of batteries of different sizes, when united in one circuit, ought not to be less than would be produced if the whole of the pairs were of the smaller size. But if on the contrary, we suppose the voltaic fluid compounded of Caloric, light and electricity, so obviously collateral products of galvanic action; the ordinary voltaic series, employed in your experiments, may owe its efficacy more to electricity—and the deflagrator more to caloric. The peculiar potency of both may be arrested when they are joined, by the incompetency of either series to convey any other compound than that which it generates. The supply of caloric from the ordinary series may be too small, that of electricity too large; and vice versa. It might be expected that each would supply the deficiency of the other; but it is well known that many principles will combine only when they are nascent. The power of my large deflagrator (described in letter II.) in producing decomposition, is certainly very disproportional to its power of evolving heat and light. When wires proceeding from the poles were placed very near each other under water, it was rapidly decomposed; but when severally introduced into the open ends of an inverted syphon, filled with that fluid, little action took place ——: Potash is deflagrated and the rosy hue of the flame indicates a decomposition. Still however the volatilization of the whole mass, and intense ignition of the metallic support, prove that the calorific influence is greatly and peculiarly predominant.

I fear that in my essays on galvanic theory, the possible activity of light, has been too much overlooked. The corpuscular changes which have been traced to the distinctive energies of this principle, are so few that we have all been in the habit, erroneously perhaps, of viewing it as an inert product in those changes, effected by caloric, electricity and chemical action, which it most strikingly characterizes. Yet reflecting on the prodigious intensity in which it has been extricated by the deflagrator, it seems wrong not to suspect it of being an effective constituent of the galvanic stream. Possibly its presence in varying proportions, may be one reason of the incompatibility of the voltaic current as generated under different circumstances, or by various

forms of apparatus. It may also suggest, why in addition to changes in the force or nature of the sensation produced by the galvanic discharges which may be considered as dependent on electric intensity, peculiarities have been observed, which are not to be thus explained. The effect on the animal frame, has been alleged to be proportional to the electrical *intensity*, the effect on metals to the *quantity*; but according to the observations of Singer (which are confirmed by mine) the electrical intensity is as great, with water as with acid, if not greater even than with the latter. The reverse is true of the shock. When the plates of the deflagrator are moistened, and withdrawn from the acid, the shock is far less powerful; yet the electrical excitement appear stronger. Light is undeniably requisite to vegetable life, perhaps it is no less necessary in the more complicated process of animal vitality, and the electric fluid may be the mean of its distribution. The miraculous difference observed in the properties of organic products, formed of the same ponderable elements, may be due to imponderable agents conveyed and fixed in them by galvanism. Hence it may arise, that the prussic acid instantaneously kills when applied to a tongue, containing the same ponderable elements. When by the intense decomposition of matter, light is always evolved; when an atom of tallow gives out enough of it to produce sensation in the retina of millions of living beings why may it not when presented in due form, influence the taste, and otherwise stimulate the nervous system. For such an office its subtilty would seem to qualify it eminently. The phenomena of the fire-fly and the glow worm prove that it may be secreted by the process of vitality.

The discovery of alkaline qualities, as well as acid, in organic products whose elements are otherwise found, whether separate or in combination, without any such qualities, and the opposite habitudes of acids and alkalies with the voltaic poles, and their power of combining with, and neutralizing each other, indicate that there may be something adventitious which causes alkalinity and acidity, and that this something is of an imponderable character, and dependent on galvanism.

In the number of your Journal for October last, I gave my reasons for believing in the existence of material im-

ponderable principles, producing the phenomena of heat light and electricity. The coexistence of these principles in the medium around us, their simultaneous, or alternate agency and appearance, during many of the most important processes of nature, seem to me to sanction a conjecture, that as ingredients in ponderable substances they may cause those surprisingly active and wonderfully diversified properties usually ascribed to apparently inadequate changes, in the proportions of ponderable elements.

In obedience to your request, I have thus displayed the ideas at present awakened in my mind by these obscure and interesting phenomena. I am not willing to assume any responsibility for the correctness of my conjectures. Possibly they may excite in you farther and more correct speculations.

Letter V.—From the Editor, to Prof. Robert Hare, M. D.

Fusion of Charcoal, *by the Deflagrator, with proofs of a current between the Poles.*

Yale College, New-Haven, May 10, 1822.

My Dear Sir,

In your memoir on your Galvanic Deflagrator, (p. 110. Vol. III. of this Journal,) when speaking of the ignition produced by that instrument, in charcoal points, you remark: "If the intensity of the light, did not produce an optical deception, by its distressing influence upon the organs of vision, the charcoal assumed a pasty consistence, as if in a state approaching to fusion.

"That charcoal should be thus softened without being destroyed by the oxygen of the atmosphere, will not appear strange, when the power of galvanism in reversing chemical affinities is remembered; and were it otherwise the air could have no access, first because of the excessive rarefaction, and in the next place as I suspect on account of the volatilization of the Carbon, forming about it a circumambient atmosphere. This last mentioned impression arose from observing, that when the experiment was performed in vacuo, there was a lively scintillation, as if the Carbon in an

aeriform state, acted as a supporter of combustion on the metal."

This paragraph, at the time of perusing it, excited in my mind a lively interest, and a strong wish to see so fine a result, as the fusion of charcoal, confirmed by an experiment admitting of no question. What you threw out by way of surmise, and without positively affirming it, I think I am now able to substantiate.

During the three last weeks of March, I was much occupied with your deflagrator. The medium of communication, between the poles, was generally, charcoal prepared for the purpose, by intensely igniting pieces of very dry mahogany, buried in a crucible, beneath white siliceous sand. The pieces of charcoal thus prepared, were about half an inch in diameter, and from one and half inch, to three inches in length; they were made, as usual, to taper to a point, and the cylindrical ends were placed in the sockets, connected with the flexible lead tubes, which form the polar terminations of the series.

The metallic coils of the deflagrator, being immersed, on bringing the charcoal points into contact, and then withdrawing them a little, the most intense ignition took place, and I was surprised to observe, that the charcoal point of *the positive pole*, instantly *shot out*, in the direction of the longer axis, and thus grew rapidly in length; it usually increased, from the 10th to the 8th of an inch, and in some instances attained nearly 1-4th of an inch in length, before it broke off and fell. Yesterday and today, I have carefully repeated these experiments, and in no instance, has this shoot from the positive pole failed to appear. It continues to increase rapidly, as long as the contiguous points of charcoal are held with such care, that they do not strike against each other. When they impinge with a slight shock, then the projecting shoot or knob breaks off and falls, and is instantly succeeded by another. The form of the projecting shoot, is sometimes cylindrical, but more generally it is that of a knob, connected with the main piece of charcoal, by a slender neck, much resembling some stalagmites. It is always a clear addition to the *length* of the charcoal, which does not suffer any waste except on the parts, *laterally* contiguous to the projecting point.

The charcoal of the negative pole, in the mean time, undergoes a change precisely the reverse. Its point instantly disappears, and a crater-shaped cavity appears in its place; it suffers a rapid diminution in the direction of its length, and immediately under the projecting and increasing point of the positive pole; but it is not diminished, or very little, on the parts laterally contiguous. If the point of the positive pole be moved over various parts of the contiguous negative charcoal, it produces a crater-shaped cavity over every place where it rests, for an instant. In every repetition of the experiment, (and the repetitions have been numerous,) this result has invariably occurred. *It appears as if the matter* at the point of the negative pole was actually transferred *to the positive, and that the accumulation there, is produced by a current flowing from the negative to the positive, or at least by an attraction exerted in that direction, and not in the other.* It does not appear easy to reconcile this fact with any electrical or igneous theory.

In order to ascertain whether the projection of the charcoal at the positive pole was caused by an actual transfer of carbon from the negative, a piece of metal was substituted for the charcoal at the negative pole, and when the two were brought into contact, the charcoal point of the positive pole remained unaltered in form, although a little shortened by the combustion. The experiments with the two charcoal points were varied by transferring, that at the positive end, (and on which a projection was already formed) to the opposite pole, and that at the negative, and in which a corresponding cavity appeared, to the positive.

The result was, that the cavity now placed at the positive pole, disappeared, and was immediately seen at the negative; while the projection, now placed at the negative pole, was transferred to the positive. These experiments were several times repeated, and uniformly with the same result. They seem to leave no doubt, *that there is a current from the negative to the positive pole, and that carbon is actually transferred by it in that direction*;* *if transferred, it must probably be in* the state of vapour, since it passes through

* Those who would contend for a current in the opposite direction, would probably say, that the projecting point of the positive pole, is formed from the carbon, contiguous on the sides, and that the stream of heat burns the cavity in the opposite pole; *in either way a current is proved.*

the ignited arch of flame, which is formed when the points are withdrawn a little distance; when it arrives at the positive pole, it there concretes in a fluid, or at least in a soft or "pasty" state.

But the most interesting thing remains yet to be stated. On examining with a magnifier, the projecting point of the positive pole, it exhibited decisive indications of having undergone *a real fusion.*

The projecting point or knob, was completely different from the charcoal beneath. Its form was that of a collection of small spheres aggregated; exhibiting perfectly, what is called in the descriptive language of Mineralogy, botryoidal or mamillary concretions. Its surface was smooth and glossy, as if covered with a varnish; the lustre was metallic, the colour inclining to grey, exhibiting sometimes iridescent hues, and it had entirely lost the fibrous structure. In short, in colour, lustre, and form, the fused charcoal bore the most striking resemblance to many of the beautiful stalactitical and botryoidal specimens of the brown hœmatite. The pores of the charcoal had all disappeared, and the matter had become sensibly harder and heavier.

I repeated the experiments, until I collected a considerable quantity of these fused masses; when they were placed contiguously, upon some dark surface, with some pieces of charcoal near them, they appeared when seen through a magnifier so entirely different from the charcoal, that they would never have been suspected to have had any connexion with it, had it not been, that occasionally some fibres of the charcoal adhered to the melted masses. The melted and unmelted charcoal, differ nearly as much in their appearance as pumice-stone and obsidian, and *quite* as much as common stones do, from volcanic scoriæ, excepting only, in the article of colour. It is to be understood, that the examination, is in every instance, made by means of a good magnifier, and under the direct light of the sun's rays, as the differences are scarcely perceptible to the naked eye, especially in an obscure light. The portions of melted charcoal, are so decidedly heavier than the unmelted, that when fragments of the two of a similar size are placed contiguously, the latter may be readily blown away by the breath, while the former will remain behind; and when the vessel, containing the pieces is inclined, the melted pieces will roll with mo-

mentum, from one side to the other in a manner, very similar to metallic substances, while the fragments of charcoal will either not move, or move very tardily.

It should be observed, that during the ignition of the charcoal points, there is a peculiar odour, somewhat resembling electricity, and a white fume rises perpendicularly, forming a well defined line above the charcoal. There was also, a distinct snap or crackling when the two points were first brought together.

Wishing to ascertain whether the Alkali, present in the charcoal, had any effect in promoting the fusion, some pieces of prepared charcoal, were thoroughly boiled in water, and were then again exposed to a strong heat in a furnace beneath sand in a crucible. These pieces when connected in the circuit exhibited the same appearances as the others and proved equally fusible.

Without destroying cabinet specimens, I could procure no diamond slivers, and have not therefore, attempted the fusion of the diamond, which must be left to another opportunity. Our circle of fusible bodies, so much enlarged by the use of your instruments, is now so nearly complete, that it would be very desirable to fill the only remaining niche, namely, that occupied by plumbago anthracite, and the diamond.

I remain as ever, truly your friend and
servant,

B. SILLIMAN.

P. S. I do not suppose, that those who repeat these experiments, will succeed with the common galvanic apparatus. I deem it indispensable, that they be performed with the *deflagrator*, and with one equal in power to mine.

ART. XIII.—*Analysis of the Tabular spar, from the vicinity of Willsborough, lake Champlain, and of the Pyroxene and Colophonite, which accompany it; by* HENRY SEYBERT, *of Philadelphia.*

1. *Tabular spar.*

This mineral is white. Lustre, pearly and splendent. It appears to be composed of coarse granular portions intimately interwoven; on a close examination, they exhibit the appearance of hexagonal tables, striated on the surface, easily frangible in the direction of the striæ, and have a cleavage in the opposite direction. Fragments highly translucent. Scratches glass, but does not scintillate with steel. Does not phosphoresce when heated.* Specific gravity 2,884. Fusible, before the blowpipe, into a transparent colourless vitreous globule. When boiled, with concentrated nitric acid, it dissolves partially, and yields a solution, which precipitates abundantly with an oxalate, or an excess of sub-carbonate of soda.

Analysis.

A. 3 grammes of Tabular spar, finely pulverized, were exposed to a red heat, in a platinum crucible, the powder remained colourless, after the calcination the weight was 2. 97 grammes, therefore the diminution, due to moisture, amounts to 0. 03 grammes, on 3 grammes, or 1. 0 per 100.

B. The calcined mineral (A) was heated to redness, during 30 minutes, with 9 grammes of caustic potash, in a silver crucible, the mass when cold was treated with water and an excess of muriatic acid, the solution was of a light yellow colour, on evaporation it became gelatinous, the dry mass was treated with water, acidulated with muriatic acid, and again moderately evaporated; it was then treated with water and filtered, the Silica, remaining on the filter, after edulcoration and calcination, weighed 1.53 grammes on 3 grammes, or 51.0 per 100.

* According to Mr. Hauy, Tableau Comparatif, p. 66, the Tabular spar from Dognazka is phosphorescent in the dark when scratched with steel; Dr. Meade who discovered this mineral in the United States, in 1809, informed me that recent specimens were likewise phosphorescent by friction.

C. After the separation of the Silica from the liquor (B,) the excess of acid was neutralized with ammonia, when treated with the hydro sulphate of ammonia, it produced a black precipitate ; this precipitate, washed and dried, was calcined, in order to volatilize the greater part of the sulphur, it was then treated with a little nitric acid and exposed to a strong red heat, it then weighed 0.04 grammes on 3 grammes, or 1.333 per 100. This precipitate on examination proved to be Alumina and Peroxide of Iron.

D. When oxalate of Potash was added to the liquor (C,) a voluminous precipitate was formed, which on exposure to a high temperature, yielded 1.38 grammes of Lime on 3 grammes, or 46.0 per 100.

E. The liquor (D,) after phosphate of soda and ammonia had been added to it, was boiled and was thus found to contain only a slight trace of Magnesia.

This mineral is composed in 100 parts of

A. Water - -	01.000	containing oxygen.
B. Silica - - -	51.000	- - 25.65
C. Alumina and Oxide of Iron - - -	01.333	- - - ——
D. Lime - - -	46.000	- - 12.92
E. Magnesia - -	a trace	- - . ——
	99.333	
	100.000	
	000.667	

This Tabular spar is, therefore, a Bisilicate of Lime, and its mineralogical formula is $Ca\ S^2$.

This substance, was by some mineralogists in America and in Europe, supposed to be Icthyopthalmite, whilst others considered it Tremolite. The above results prove, that its composition differs essentially from that of the minerals with which it had been confounded. On comparing the external characters with Karsten's account of the Tafelspath (a mineral until lately, found only at Dognazka in Hungary,) but more especially from its chemical composition, I determined it to belong to that species. "The Tafelspath of Hungary is milk white, and consists of coarse granular hexaedral portions intimately interwoven. alternately channelled on the disjointed surfaces." According to

Klaproth, Hemgariar variety is constituted per 100 of Silica 50.0, Lime 45.0, and Water 5.0.*

The chief difference of my results, from those of Professor Klaproth, concerns the water contained in the specimens respectively examined. M. Berzelius considers the water in this mineral as *accidental*, and observes that some specimens contain no water.† My statements are confirmed by an analysis of the Tabular spar, from Pargas, by M. Bonsdorff, of Albo;‡ his experiments gave the following reresults per 100, viz.—Silica 52.58, Lime 44.45. Magnesia 0.68, Protoxide of Iron 1.13, Alumina a trace, Volatile matter 0.99.

It is an interesting fact, that this mineral, whether found in Hungary, Sweden, or in the United States, is constantly associated with substances of corresponding characters; that of Dognazka is united with brown crystallized Garnets and blue calcareous spar: that of Pargas, with black sphene, an amorphous mineral, of a reddish colour, resembling Idocrase or Garnet, and small grains of a green substance, resembling Actynolite (probably Pyroxene:) that of the United States with Colophonite and Pyroxene.

2. *Green Pyroxene.*

Colour emerald green, powder nearly white. Transparent. Lustre, vitreous. Scratches glass. Has a cleavage. Granular, and is found imbedded in Tabular spar, accompanied by Colophonite, the grains are frequently compressed. Not magnetic. Specific gravity 3.377. Fusible, before the blowpipe, into a dark opaque globule.

Analysis.

A. 3 grammes of this mineral, having been selected with great care, were reduced to an impalpable powder, and exposed to a red heat; the color of the powder underwent no alteration, there was therefore no absorption of oxygen; the weight, after the calcination, was 2.98 grammes therefore the moisture amounts to 0.02 grammes on 3 grammes, or 0.666 per 100.

* Beitræge, 3. p. 289.
† Nouveau Systeme Mineralogique, p. 28.
‡ Annals of Philosophy, Oct. 1820. p. 300.

B. The residue of the calcination (A,) was treated with caustic potash, as in the preceding analysis, it was then greenish yellow, and the water, which was used to detach it from the crucible, assumed a light green colour, hence a trace of Manganese. By the usual treatment, with an excess of muriatic acid and the subsequent evaporation of the liquor, &c., the Silica obtained weighed 1.51 grammes on 3 grammes, or 53.333 per 100.

C. After the excess of acid, of the liquor (B) was neutralized with ammonia, it was treated with the hydro-sulphate of ammonia, the black precipitate thus produced, after ignition and calcination with nitric acid, yielded 0.70 grammes of a residue, which, on being repeatedly treated with caustic potash, was found to consist of 0.664 grammes of Peroxide of Iron (but owing to the green colour of the mineral, the Iron must be estimated as a protoxide,) and the 0.664 grammes of peroxide an equivalent to 0.612 grammes of Protoxide on 3 grammes, or 20.40 per 100; and Alumina 0.046 grammes, on 3 grammes, or 1.533 per 100.

D. The lime obtained by the calcination of the calcareous oxalate, which was produced by the addition of oxalate of potash to the liquor, (C) amounted to 0.58 grammes on 3 grammes, or 19.333 per 100.

E. The Magnesia was precipitated in the liquor, (D) by Phosphate of Soda and Ammonia, the ammoniacal Phosphate of Magnesia thus formed, after being calcined, gave 0.56 grammes of phosphate of Magnesia, equivalent to 0.205 grammes of Magnesia on 3 grs. or, 6.833 per 100.

Therefore the constituents of this mineral are,

	per 100 parts,	
A. Water, - -	0.666,	containing oxygen, ——
B. Silica, - - -	50.333, - - -	25.31
B. Protoxide of Manganese,	a trace - - -	——
C. Protoxide of Iron, -	20.400, - - -	04.64
C. Alumina, - -	01.533, - - -	——
D. Lime, - - -	19.333, - - -	05.43
E. Magnesia, -	06.833, - - -	02.64
	99.098	
	100.000	
	000.902	Loss.

On comparing the oxygen of the Silica, with that of the bases, it is evident, that it forms with them Bisilicates, and the mineralogical formula is $MgS^2+2CaS^2+2FeS^2$.

3. *Colophonite,*

Occurs frequently disseminated and imbedded with green Pyroxene in Tabular spar, sometimes it forms considerable veins in that mineral. Colour in mass, deep reddish brown, in the state of powder it has a yellowish tinge. Irised on the outer surface. Lustre resinous. Granular, the single grains are highly translucent Fracture of the mass irregular, the grains have a cleavage. Scratches glass and scintillates with steel. Easily frangible. Not magnetic. Specific gravity, 3.896. Fusible before the blowpipe into an opaque black bead.

Analysis.

A. 3 grammes of the pulverized mineral after exposure to a red heat weighed 2.99 grammes therefore the moisture dissipated by this treatment amounts to 0.01 grammes, on 3 grammes or 0.333 per 100. The protoxide of Iron absorbed no oxygen for the color was not altered.

B. The calcined mineral, (A) when boiled with nitro-muriatic acid became gelatinous, yielding a solution of a reddish yellow colour, the whole was evaporated to a dry mass, it was then heated with water, acidulated with muriatic acid, and again moderately evaporated; the residue was treated with water and filtered, the Silica remaining, on the filter after being washed and heated to redness weighed 1.14 grammes on 3 grammes or 38.00 per 100. This product on examination proved to be free from Titanium.

C The filtered liquor (B) was neutralized with caustic potash, the solution when heated with the hydro sulphate of potash gave a black precipitate which having been heated as in the analysis of the Tabular spar yielded a residue weighing 1.00 grammes, this was repeatedly calcined with 3 times its weight of caustic potash, no camelion having been produced, it was evident that the mineral in question contained no manganese. After the entire separation of the Alumina was effected the Peroxide of Iron weighed 0.82

grammes. A portion of the Colophonite in the state of a fine powder was treated with nitric acid and calcined, and became of a dark red colour, this shewed that the Iron exists in the state of a protoxide and the 0.82 grammes of peroxide are equivalent to 0.756 grammes of Protoxide on 3 grammes or 25.20 per 100.

On estimating the Alumina contained in the Saline liquor by difference we have 0.18 grammes on 3 grammes or 6.0 per 100.

D. When oxalate of potash was added to the preceding liquor (C) a precipitate was formed, which after being washed and strongly calcined gave 0.87 grammes of Lime on 3 grs. or 29.0 per 100.

E. The liquor (D) was boiled with caustic potash, and was thus found to contain no Magnesia.

The result of this analysis is thus, per 100 parts.

A. Water, - -	00.333	containing oxygen,	
B. Silica, - -	38.000	- - -	19.11
C. Protoxide of Iron,	25.200	- - -	05.73
C. Alumina, - -	06.000	- - -	02.80
D. Lime, - -	29.000	- - -	08.14
	98.533		
	100.000		
	001.467	Loss.	

Therefore the mineralogical formula of this Garnet is $AlS^2 + 2FeS + 3CaS$.

N. B. The results of my analysis of the Tabular spar, were communicated to the Academy of Natural Sciences the 5th of March, 1822.

Art. XIV.—*Analysis of the calcareous oxide of Tungsten, from Huntington. Con.* By George T. Bowen.

This mineral was discovered a short time since among some ores brought for examination by Mr. E. Lane. The specimen submitted to analysis was massive. Its colour was yellowish gray—fracture small foliated—lustre resinous

—brittle—is scratched by a knife—infusible before the blowpipe. The specific gravity of a pure piece was 5.98. It occurs in a gangue of quartz, associated with the ferruginous oxide of Tungsten.*

Analysis.

A. Distilled water digested upon the mineral in powder, dissolved nothing. It was then treated with ammonia, but no portion of it was dissolved. Fifty grains exposed for one hour to a high red heat in a platina crucible, lost nothing perceptible of their weight.

B. One hundred grains of the mineral reduced to a fine powder were mixed with three times their weight of pure caustic potash and exposed for one hour to a moderate red heat in a crucible of pure silver. The contents of the crucible when removed from the fire, were of a blue colour resembling smalt. The mass after having been digested with water was thrown on a filter and the insoluble powder repeatedly washed with distilled water. Upon this powder when collected, diluted muriatic acid was poured when it was entirely dissolved, with effervescence excepting .5 grains of silex.

C. The muriatic solution was then evaporated to dryness, and the mass treated with distilled water, when there remained undissolved, one grain of a powder having a dark brown colour. Nitric acid when digested upon it, dissolved it in part and left .25 grain silex. The nitric solution was precipitated by ammonia; the precipitate when washed and dried, weighed .74 grain. It was then treated with muriate of ammonia, to which a small quantity of sugar was added in order to separate the oxide of manganese.† The oxide of iron remaining undissolved amounted to .55 grains; we have then by difference, oxide of manganese equal to .19 grain.

D. The solution of the muriate in water was tested for iron, but none could be discovered. It was then decomposed by carbonate of soda at a boiling heat; the precipi-

* It is also accompanied by native bismuth, native silver, galena, sulphate of lead, and magnetic, and common pyrites.

† This method of separating iron from manganese is recommended by Mr. Faraday. Jour. Royal Institution. VI. 357.

tate which was produced when collected and dried at a low red heat weighed 34.75 grains. It was redissolved in muriatic acid with effervescence, excepting .46 of silex, and again precipitated by sulphuric acid; it was therefore carbonate of lime. Deducting the .46 grain of silex, it amounted to 34.29 grains of carbonate, which equal 19.36 lime.

E. The alkaline solution containing the tungstic acid was evaporated to dryness, when it appeared in the form of small crytalline grains. The mass being treated with water there remained undissolved a brown powder, which when dried, weighed 1.75 grain. Nitric acid dissolved the metallic oxides by which it was coloured, and left 1.13 grains of silex. The nitric solution was precipitated by ammonia, and the precipitate afterwards treated with muriate of ammonia as before, (C) when it was found to consist of oxide of iron .48 grain, and oxide of manganese .12. The results (in C and E) give a total of oxide of iron amounting to 1.03 grains and of oxide of manganese equal to .31 grain.

F. The solution (E) was then decomposed by muriatic acid, and the precipitate which was produced collected and dried at a red heat; it assumed a yellow colour; and weighed 76.25 grains. Liquid ammonia when digested upon it dissolved it almost entirely, leaving .20 grain of silex. The ammoniacal solution when evaporated yielded white needle form crystals, which became of a yellow colour when calcined. They were completely redissolved in ammonia, and again precipitated by acids. This powder was therefore the tungstic acid. Deducting the 20 grains of silex, it amounted to 76.05 grains. The results (in B. C. D. E. and F.) give a total of silex amounting to 2.54 grains.

One hundred grains of the calcareous oxide of Tungsten consist, according to this analysis of

Tungstic acid, - - -	76.05
Lime, - - - - -	19.36
Silex, - - - - -	2.54
Oxide of Iron, - - - -	1.03
Oxide of Manganese, - - -	0.31
	99.29
	100.00
	000.79 Loss.

* * * * * * *

The calcareous oxide of Tungsten of which the above is an analysis exists pure and is uncontaminated by any foreign substances. There however occurs in the same mines a tungstate of lime, mechanically mixed with the native massive oxide of Tungsten, mentioned in the American Journal of Science, Vol. IV. p. 187. The native oxide, in minute veins, is disseminated through the tungstate of lime, and is easily distinguished by its bright orange colour, from the calcareous oxide, which colour is yellowish gray. When the powder of this mineral is treated with warm ammonia, the native oxide is dissolved, while the tungstate of lime remains unaffected.

The yellow oxide of tungsten occurs also disseminated in a pulverulent form in cavities and fissures in the ferruginous tungsten of Mr. Lane's mine. See Vol. IV. p. 52 and 187 of this Journal.

Art. XV.—*Wet or damp clothes, good conductors of lightning. Illustrated in the case of John Williams Esq. of Conway, Massachusetts.*

[Communicated for this Journal by the Rev. Edward Hitchcock.]

If the following statement communicated to me by J. Williams Esq. be thought subservient to the cause of humanity or science, it is offered for insertion in the American Journal of Science.

Sept. 2nd, 1816, about sun-set a violent thunder storm arose from the north-west; and for more than three hours, the heavens were in an almost constant blaze. Mr. Williams was standing in the front door of his house, in Conway, with his face directed southerly; when he was thrown senseless on the floor by a stroke of the lightning. It seems the fluid first entered the roof of his house a few feet above his head, passed down the right hand side of the door, tearing off the ceiling—entered his right shoulder, went along his right arm to the hand—then struck his right hip, and running spirally down the back part of his thigh till it reached the knee, the main part of the charge passed into the left leg and went out through the sole of the shoe while

the residue of the charge, followed down the right leg. The charge entered the wall of the cellar and made a rent therein. Marks of the lightning were also visible at the northwest angle of the house; where, the ceiling of the kitchen was torn off, a plank split in a well room, and two furrows ploughed in the earth; one of which, passed under a Lombardy poplar tree, standing in the door yard. The right sleeve of Mr. W's shirt and coat, both legs of his pantaloons, and the stocking on his left leg, were torn almost entirely open, and so mutilated several inches in width, as to hang in shreds and threads, appearing as if drawn across a hetchel. His coat was *seersucker*, (cotton and silk,) and the lining, striped linen—his shirt was linen—the pantaloons Nankeenet or (linen and cotton,) and the stockings, cotton. One of the quarters of the left shoe was torn off—the sole much mutilated, and a hole perforated in it, as if a large nail had been driven through it.

Another circumstance important to be noticed, is, that his clothes were a little wet; he having been exposed to the storm in its commencement.

Mr. W. remained senseless a few minutes, and says that the sensation he experienced while resuscitating, is faintly described by comparing it with that of Gautimozin when stretched upon the burning coals. Indeed the first impression on his mind, which he recollects, was, that he was actually immersed in the "furnace of fire," described in the sacred scriptures. His right arm was scorched its whole length—a spot several inches in diameter on his right hip—spaces on both legs below the knees and on the left foot, and his feet were benumbed for several days. His senses soon returned, and after the fiery anguish above named, little pain was felt, and in a fortnight, or three weeks, he was restored to usual health.

A candle burning at the time of the stroke near the centre of the west room in Mr. W's house was extinguished; and it was found difficult to relight it. The usual sulphurous smell was noticed.

On the south and west sides of Mr. W's house, were several Lombardy poplar trees sixty or seventy feet high, rising thirty or forty feet above his house, which was one story and an half. One of these trees is not more than six feet from the spot where the lightning first struck, and yet, nei-

ther this tree nor any of the others were affected. It ought however to be mentioned that there is an iron bolt, six inches long, in the top of the post near the door of the house, and perhaps this attracted the fluid.

Query. Are not Lombardy poplars worse conductors of lightning than other timber, and therefore less valuable near dwellings?

Mr. W.'s house stands nearly at the foot on the west side of a steep rocky hill of mica slate, two or three hundred feet high. I would make the enquiry, whether, in this part of our country, (as most of our thunder storms pass from west to east,) the western side of mountains is not more frequently struck with lightning than the eastern? For, before the clouds reach the eastern side of hills, are they not usually in a good measure discharged?

A person examining Mr. Williams' clothes, which were mutilated in the manner described above, and which are still carefully preserved, would not suppose it possible for him to have escaped with his life. I feel satisfied that he owes his life to the circumstance that his garments were slightly wet. To support this opinion, I make the following extracts from Dr. Franklin's letters to P. Collinson Esq. Third London edition, pa. 36 and 47.

"Electrical fire loves water, is strongly attracted by it, and they can subsist together."

"It is safer to be in the open field (during a thunder storm) for another reason. When the clothes are wet, if a flash in its way to the ground should strike your head, it will run in the water over the surface of your body; whereas if your clothes were dry, it would go through the body."

"Hence a wet rat cannot be killed by the exploding electrical bottle, when a dry rat may."

These facts, at first view, appear conclusive on this point. I am aware however, that Mr. W's clothes were all non-conductors, and "that the fluids of the human body are better conductors of electricity than water." (Rees Cycloped. Art. Electrical.) It does not appear, however, from the experiment of Rees referred to, that animal fluids, *while they remain in the system*, are better conductors than water. But I will not enlarge—If the opinion I have advanced be not tenable, let it be abandoned: for the truth on this subject may be of some consequence. Remarks by the Editor of the Journal would be very acceptable.

REMARK.

The Editor entirely coincides with the Rev. Mr. Hitchcock, in opinion as to the cause of the preservation of Mr. W lliams' life. It occurs to him however that as Mr. Williaims' clothes were but slightly wet, his skin was probably dry. Although therefore the animal fluids may be better conductors than water, yet the dry cuticle or skin, is not a good conductor, and therefore the electrical current preferred to take its course through the moisture in the clothes rather than to force its way through the skin to the animal fluids.

We subjoin Mr. Williams' own minute of the facts, for although substantially embraced in Mr. Hitchcock's account—the relation of the sufferer himself has in it interesting traits of verisimilitude.

Description of the Plate annexed.

No. 1. Mr. W.'s Pantaloons as torn by the lightning.
— 2. ——— Stocking.
— 3. ——— Shoe exhibiting the perforation in the sole.
— 4. ——— Quarter of the shoe torn off.
— 5. ——— Coat sleeve.
— 6. ——— Shirt sleeve.
1✗ A weeping willow.
✗ Tall Lombardy poplars.

Doors that were so far open.

B. 3. 3. Furrows ploughed in the ground by the lightning.

2. The position of J. W. when struck down—he was looking to the south east—the first of the fluid on the house was at the bottom course of shingle splitting four inches—then started off the eave trough 20 feet in length—then stripping off the post and door casings and some of the outside covering—took my right shoulder below the joint, burning and scorching to the end of the sleeve, then the right hip burning seven inches square, then down the inside of the lower limbs with a streak of the burning to the knees, burning, on the inside of the right leg, the bigness of a hand, and left the leg, leaving two holes through the stocking—from the left knee to three inches below, no burn—then burning down to the heel and under it, and blistering the lap of the left foot half the surface of it and stripping the clothes in a manner not easily described—I was thrown prostrate, my head to the east, my face to the north, senseless—the length of time, I am not able to ascertain, nor to describe the sensation on coming to, my legs were so benumbed as to be useless, and so remained till the lancet was used, which gave some relief. The physician wet cloths in the oil of terabinth through the night and kept them on for four days, when the fire was principally extracted—I was compelled to lie nine days on the left side—the 12th sat up half a day at times, and the 14th began to walk.

Table on which a large candle was burning, which was put out by the fluid, and which afterwards it was difficult to light. Mrs. Williams standing at the east end of the table at the time of the shock. It was

powerful on the left ear for three or four hours. It caused in the head a ringing like the ringing of tumblers. The residue of the family, three children, were in bed in the chambers, and not otherwise affected than by a start by the report.

A neighbour six rods distant standing at his door was stunned and falling, but was caught by his family.

Another family in a small building two rods distant only affected by the report—at the north-West corner of the room, a large heavy table and chair moved two feet from the wall, the whole ceiling started. The fluid passed down after leaving my body, between the sill and a stone step through the wall and four feet downwards throwing off much pointing. The dotted line the south side shews the course of the fluid on the cellar wall—the residue its course on the sill, floor or plank on the north side, west on the ground injuring the house and furniture more or less. I had been out in a little dash of rain ten minutes before the shock—the clothes were moist.

Several strokes of lightning apparently from the same explosion.

Extract of a letter to the Editor from Gen. Ephraim Hoyt, dated,

Deerfield, Mass. July, 21, 1821.

One question in Electricity and I have done. Have you any certain proofs that lightning strikes at several places (say from twenty to forty rods distance) at the same instant. In a late thunder shower a tree in my garden three rods from my house, a post in a fence twenty rods distant and a walnut tree in the meadow forty rods distant were struck as we suppose at the same instant. The shock was tremendous, and I believe the tree in my garden saved my house and probably our lives. I am of opinion that the lightning ascended. I am sometimes puzzled to account for Electrical Phenomena on known laws and am not certain of the efficacy of rods though I believe them useful in *many cases*.

Art. XVI.—*Relation of a case of suspended animation by drowning; by* Lockwood W. Smith.

Read at the annual examination in the Medical Institution of Yale College, March, 1822.

I have selected this as a subject for the present dissertation. First, because it came under my own observation.—

Secondly, because one remedy was made use of which I have not found in authors upon this subject.—And thirdly, because I think electricity which is disapproved of by most authors, and more from theory than experience was used in this case with obvious advantage. The remedy to which I refer as the one not mentioned by authors, is Tincture of Cantharides in form of injection. This however having been applied at the same time with remedies that are recommended by writers in general, renders it utterly impossible to determine whether it had any effect in the case or not. Yet this certainly is the fact that it was followed by no ill consequence, but on the contrary with the recovery of the patient; the sole thing aimed at in the administration of any medicine.

The principle of life appears, in cases of drowning, not to be entirely extinguished, but to be merely suspended *for a certain length of time.* And it is capable, if proper means be employed *within that length of time*, of being again excited to action. How long after drowning, this principle remains in a state of mere suspension we knew not, nor indeed in any case of suspended animation, are we absolutely sure of death, until symptoms of putrefaction make their appearance. This then implies that in every case where these symptoms are not present, we should immediately, upon the body being found, make every possible effort to restore it to life.

The method which I am about to describe was prasticed by the late Dr. Strong, of Petersburg (Va.) and although I was at the time, unacquainted with medicine, still I think I shall be able to state the treatment with a sufficient degree of accuracy.

I will omit the particular circumstances of the accident and merely mention that six persons, of which number I was one, were overset from a boat in Appomatox River. Five, with difficulty, reached the shore, while the other having been caught under the boat, remained in the water. We soon procured another boat, but such were the circumstances, that it was nearly, if not full half an hour before we were enabled to reach the shore with the body. One was immediately sent to inform the friends of the accident, while the remaining four were employed in conveying the body to the nearest house. Happily for the young man

the person sent to inform the friends, met on his way the Physician before mentioned, and to him he of course communicated the accident. Dr. Strong being near his home, immediately took his Electrical machine and proceeded to the house where he found us just arrived with the body. I do not recollect the appearance of the body any farther than that the face was of a dark colour, and as far as we could perceive, life completely extinguished. Dr. Strong adopted the following active means —He first ordered the body to be stripped of the wet clothes and at the same time a bed to be prepared with woollen blankets thoroughly warmed with a common bed pan, and in addition to these he directed a kettle of warm water. As soon as the clothes were off, he wiped the body with a flannel cloth, and laid it between the warm blankets. He then observed that appearances were very much against him, and he was doubtful whether he should succeed. Fortunately however, he did not despair, but still persevered in the application of his remedies. While he was preparing the electricity he directed the body to be rubbed with flannel cloths. He then passed the electric sparks twice in succession through the shoulders and at the same time friction was continued over the whole body, but more particularly about the thorax. The lungs were next inflated by means of the common bellows. All this Dr. Strong observed had no effect. The water by this time was sufficiently warm for his purpose, and of which he took about a pint; to this he added a small quantity of Brandy, with about half a table spoon full of Tinct. Cantharides, and gave it per an. The temperature of the water I do not know. The body in an erect posture, was next conveyed towards the fire, while the bed was again prepared with warm blankets, and the body returned. The electricity was a second time applied, and was immediately followed by a convulsive sigh. I was at this time rubbing the breast with a flannel cloth and could perceive a convulsive effort within the thorax which I supposed to be the first returning throb of the heart, and which was repeated three or four times. The lungs were again inflated, and this also was immediately followed by a convulsive effort to breathe, and by an evident palpitation of the heart. The surface of the body was quite warm at this time, and the friction was consequently discontinued. Air

was a third time blown into the lungs and was followed by a discharge of water from the mouth and nostrils. Aqua ammoniæ was applied to the nose, and volatile linament to the breast and back. The person soon began to breathe with tolerable freedom, and was able to swallow some warm cordial; a small quantity of blood was now taken, and he was the next day conveyed home to his friends.

New-Haven, March 25th, 1822.

Art. XVII.—*On the Natural History of the Ocean, with two sea journals.*

TO PROFESSOR SILLIMAN.

New-York, April, 2, 1822.

My Dear Sir,

A short time ago, my friend, C. A. Davis, Esq. handed to me a journal kept on board the U. S. Ship Columbus, Com. Bainbridge. Upon comparing it with one that I kept on my passage from Liverpool to New-York, I was induced to turn my attention to the waters of the Ocean—and have drawn up a paper on its Natural History, which I now offer to you. I have of course been obliged to consult several works and papers, from which I have selected such information as accorded with my design.

I place both journals at your disposal.

With much respect,
I have the honor to be
Very truly, yours,
JER. VAN RENSSELAER.

Colour.—Deep indigo blue—green on soundings;—these tints being most distinctly marked in the tropics. In the polar regions, the waters are greenish. Near the Cape of Good Hope, the sea has a reddish tinge, in the month of March, from marine animals: the same appearance is produced by the same cause at the mouth of the river Plate. Admiral Byron observed this on his passage to Rio Janeiro. The bay of California is red, in parts, from the abun-

dance of red fish. Near Sumatra and on the coast of Chili, the water seems red from a minute vegetable substance that floats in it.

Temperature.—At the Equator, the surface water is 80°; Farenh.; at 28 N. Lat. it is 68°; at 47 N. Lat. it is 58°; in the arctic regions it is about 30°; diminishing as the latitude increases.

The temperature, at a considerable depth, is higher on approaching a coast; but at a distance from land it diminishes as the depth increases. When the atmosphere is 50°; and the surface water 40°; it will be perhaps only 25° at the depth of 50 fathoms. The reverse of this was supposed to be true in lakes, but the late experiments of M. de la Beche, prove the Swiss Lakes to agree in this particular with the variations of ocean temperature.

The diminution of temperature on the banks of Newfoundland is so great, that the thermometer may justly be considered as an indicator of the approach to land on the east coast of the U. States.

The Gulf Stream is about 15° warmer than the surrounding bed of the ocean. Summary—

1. The temperature of the ocean diminishes from the Equator to the Polar regions.

2. It decreases near Islands and Continents.

3. It diminishes in wide seas, according to the depth from which it is drawn: except in the polar seas, where the reverse obtains.

4. It is less on sand banks.

Remarks.—It is owing to the extreme mildness and equability of temperature enjoyed by the ocean and supernatant atmosphere, that the good effects are derived from sea air in pulmonary complaints: and not from the saline humidity of the air, as has been asserted. This circumstance has not been sufficiently insisted upon by medical men. We may learn from it the utility of sending patients on a voyage into the wide ocean, where the air is not affected by the various changes on land; we may also see the inutility of coasting voyages for consumptive persons.

Specific Gravity.—The experiments of the celebrated Capt. Scoresby, Dr. Marcet, and Dr. Traill sanction the following inferences.

1. The sp. gr. of the waters of the Atlantic decreases from the Equator to the poles: being at the Equator 1.0295;

and in N. Lat. 66°–1.0259, according to Scoresby: but 1.020, according to Capt. Ross.

2. The sp. gr. increases with the depth from which it is drawn.

3. The Mediterranean sea has a greater sp. gr. than the Atlantic.

4. The water of the Baltic has a less sp. gr. than the Atlantic, being 1.014.

Capt. Scoresby found that the uniformity in the increasing density of ocean waters, was interrupted by the influence of ice.

The 2nd inference is from many experiments on sea water drawn from different depths, and which were found uniform, except when interrupted by partial currents or the influence of ice. The density increasing with the depth of the ocean, Dr. Brewster attributes to the "imperfect elasticity of water, preventing its particles, when compressed by the superincumbent column, from regaining their original condition, when the pressure is removed."

Remarks.—In making experiments upon the density of sea water, Scoresby's Marine Diver is the only instrument calculated to procure it with certainty, from any given depth. For the mechanical compression of water, the Bathometer of our countryman Perkins should be used. "In this machine, water, inclosed in a brass tube, the sides of which need not exceed one tenth of an inch in thickness, is compressed by a solid piston, sliding in a leathern collar, and acted on by the superincumbent column when sunk in the depths of the ocean." (Brand's Journal, and this Journal V. III. p. 347.

Depth.—It is supposed by Hydrographers, and with apparent probability, that the inequalities of the bottom of the ocean are equal to those on the surface of the land. From 1774 to 1785, Cook was endeavouring to find soundings in the Pacific with 250 fathoms of line. Scoresby has used 1200 fathoms in the arctic seas, without finding bottom.

Near to land the depth varies according to the elevation of the coast—if this be steep, the water is usually deep, and the anchorage bad.

Remark.—The sounding line generally used, is inaccurate. The best machine for this purpose, is one invented by Massy, now constantly used in the English Navy, with

which they may sound 80 fathoms, while the vessel is going three miles per hour.

Saltness of the Sea.—Varies in different latitudes and localities. In the Tropical and Polar regions, the saltness is the same, diminishing gradually on either side to the temperate. In bays, arms, and at the mouths of rivers, the water contains less salt.

It is doubtful if the saltness does not vary with the depth.

The salt is deposited when sea water freezes.

The Mediterranean is salter than the Atlantic; the Baltic less salt.

Generally speaking, the saline matter of the Atlantic is from three to four per cent. say in 1000 grains of sea water are the following, viz.:—

Muriate of Soda, - -	30.80
Magnesian Salts, - - -	04.00
Sulphate of Lime, - -	00.80
	35.60 or 3.56 per cent.

Sea Ice.—Sea water freezes at 28°. Buffon doubted if it ever froze. Sea ice varies in colour from white and grey, to greenish and sappharine. Its forms are various presenting every shape which fancy can create. Scoresby notices sixteen kinds, known among sailors. Sea ice when melted affords fresh water. Mountains of ice have been seen on the banks of Newfoundland, above 2,000 miles from the place of its formation. They are heavier than the water, and only one eighth appears above the surface. Their approach is known by the effect they produce on the atmosphere—and by the ice-blink, a luminous appearance in the air above them. It is supposed that the poles are surrounded by ice, which prevents access to them. The nearest approach to the North Pole has been the latitude of 82°, or within 510 miles. The nearest approach to the South Pole, has been latitude 72, by Cook, or within 1130 miles. It is a matter of conjecture if either pole will ever be visited.

Motions of the Sea, are of three kinds, viz:—

I. Motion of Waves. II. Motion of Currents. III. Motion of Tides.

1. The motion of waves is preserved by the law of gravitation; the sinking of one wave raising others. It is not known how deep the sea is agitated: divers say to a great

depth; but it is estimated to extend only fifteen fathoms below the surface. According to Boyle's experiments, the wind never affects the water lower than six feet; so that in a calm, the waves of the ocean never exceed twelve feet.

In equatorial regions, the waters must be more agitated than in the polar regions, from the centrifugal force. When the water is very deep, waves have no progressive motion, but remain in situ: but if the bottom is rocky, and not very deep, the waves are interrupted, sent back, and form *breakers.*

Oil spread on the surface of the sea, smooths the water, in some measure, as was noticed by Dr. Franklin; and among the ancients by Aristotle, Pliny, and Plutarch, who mentions that the divers took oil in their mouths, and let it out when under the water, to smooth the surface above them. In the Bermudas, oil is now used to render the water clear for fishing.

Dr. Forster at sea in 1797 saw that the grease thrown overboard by the Cook affected the water to a great distance; and throwing overboard a quantity of oil, he found that it calmed all that portion of the waters. He adds, a teaspoonful spread over several yards: and explains the effect by saying, that the wind could not get a purchase to raise the first rimples, which by increasing, become waves.

II. Motion of Currents.

1. Equinoctial currents. Between the Tropics there is a constant motion of the sea from east to west, at the rate of nine or ten miles in the twenty-four hours, which seems caused by the trade winds. Commencing on the West coast of America, and running with great violence to the east coast of Africa, thence on Asia, and again back to the east coast of America. Its course is determined by the land it meets with, and, accommodating itself to the coast, seems to have assisted in forming the Bay of Bengal: whence it runs to the Coromandel coast between Ceylon and Asia.

2. Polar currents, running to the Equator, are mentioned by Humboldt, and Scoresby, with a velocity of from one to three miles an hour. Their temperature is lower than the surrounding ocean.

3. Upper and under currents; or counter currents, appear in gulphs, bays and enclosed seas. The Atlantic flows into the Mediterranean superficially, while the surplus wa-

ters are carried out below. Between the sea of Marmora and the Euxine these currents exist. Similar motions have been observed at the entrance of the Persian gulf: though the existence of counter currents is not well established.

4. The Gulf Stream. It is characterised by its higher temperature,—its blue deeper than the ocean—its waters more salt—with an atmosphere finer and lighter. It performs a circuit of 3,800 leagues in two years and ten months. The anecdote of the tree from Honduras, mentioned by Humboldt is well known. American trees are yearly deposited on the coast of Ireland. Wind increases the velocity of the stream. It is recorded that the Filbury, English man of war, was burnt near Jamaica, and that the masts were found near Scotland. The bowsprit of the Little Belt was conveyed nineteen months in a northern direction to the mouth of the B—— roads.

Wallace says that in 1682, Esquimaux in leathern canoes came to the Orkney Islands.

III. Motion of the tides. The tides are periodical oscillations of the sea, caused by the sun and moon; but more particularly by the latter. The waters rise highest when the sun and moon are in conjunction and in opposition: the two surfaces being then raised, and producing a more spheroidal form even in the equatorial diameter. (Enf. prop. CLXXIV.) The moon's attraction is nearly three times greater than that of the sun.

Between the tropics the tides set eastward; in the northern frozen ocean they are weak; of the antarctic nothing is known.

The highest tides are on the coast of France, where they are driven from the English coast, and rise seven or eight fathoms.

Luminousness of the Sea, is more evident at particular times and places. Vespucius was the first modern who noticed it. Bacon observed it, and Boyle collected theories to account for it. In 1703 it first attracted attention, and there is a letter, dated that year from Genoa to Paris, stating that the sea had been luminous fourteen nights, which the learned societies in Paris did not believe.

Four causes have been assigned for it.

1. Absorbed solar light.
2. Marine animals.
3. Electricity.
4. Decayed animal, and vegetable matter.

1. Absorbed solar light. Wilson of Edinburgh made many experiments to ascertain if this was true. He found that water retained this property when it had been covered with oil, or when drawn from a great depth. Surface water exposed to the sun's rays retained it. The electronometer did not affect it.

Many substances on land absorb light, and travellers in warm climates are often benefitted by the emission of it.

Gregg mentions a man who could read in the dark—and another who could do the same after drinking wine.

2. Marine animals. Dr. Forster, Oct. 29. 1772, off the Cape of Good Hope, near the shore in a storm, observed every wave to present a luminous crest; and that there was a phosphoric line on the sides of the ship where the waves broke. He also saw large luminous bodies moving in the water, and found that they were fishes; and that when near each other, the small ones swam from the larger. On examining a bucket of water, the luminous particles subsided; but the same property was manifested on agitation. These particles were animals, globular, gelatinous, brownish, and transparent. On the coast of Malabar they are very brilliant. There are several species of animals engaged in this phenomenon: but chiefly two—the Medusa and Actinia. The former are microscopic, and abundant in warm climates—the latter occasionally exhibit a remarkably strong phosphorescence. Sir Jos. Banks mentions a crustacea which emitted light equal in quantity and lustre to that of the glow worm.

3. Electric luminousness is seen in the wake of ships, like stars and globules: sometimes extending over a great part of the ocean. In the Indian seas, it forebodes a change of weather.

4. Decayed animal and vegetable substances frequently become phosphorescent; and produce on agitation, the most brilliant light. It is useless to specify, where so many possess this property.*

* Since finishing this paper, I have seen in the Edinburgh Philos. Journal a notice of a paper on the "Luminosity on the sea," by Dr. MacCulloch, published in the Quarterly Journal of Science and Arts:—and of another paper on the same subject by Dr. Murray, in the 3d Vol. of the Trans. of the Wernerian Society; which I believe have not yet reached this country—at least I have not had an opportunity of seeing them.

Water Spouts.—At one period they were supposed to be Volcanic. Berthollet and Franklin thought them electric: the clouds and water mutually attracting each other, and they thought their idea was confirmed by the accompanying lightning. Oliver supposed them occasioned by the suction of a cloud. Perhaps the nearest approach to truth is the supposition of the Hon. Capt. Napier. He supposes that many opposite currents of wind, all pointing to a certain centre; and coming in contact with each other, with unequal forces, cause a rotary motion or current of themselves round a central space, which, not partaking of an equal, or its former pressure, naturally becomes rarified by the existing heat, to such an extent, that it speedily acquires a state in a great degree approximating to that of a vacuum.

This continued rotary motion of the air forms a kind of whirlwind: and the pressure of the external atmosphere at the base, forcing the water to a reasonable height up the rarified space within, it is then carried upwards by the mechanical action of the wind, in light and unconnected streaks. The space at the bottom now becoming void, is regularly replenished by the pressure from without, till the whole spout is perfectly completed.

The water having now arrived at the region of the clouds, it is naturally attracted, diffused and connected with and among them; increasing in density and extent, till the lower atmosphere becoming now lighter than the clouds above, these enormous masses, gradually settling downwards, distend, burst, and are dissipated in rain.

A notice of the inhabitants of the ocean belongs more particularly to the zoologist. I shall give only two extracts tending to show the immense number of minute animals in the Greenland seas. They will at the same time exhibit the close investigation and research of that accurate observer, Capt. Scoresby.

On examining some olive green water, he found the number of medusæ to be immense. They were about one fourth of an inch asunder. In this proportion, a cubic inch of water must contain sixty-four: a cubic foot 110,592; a cubic fathom 23,887,872; and a cubical mile 23,888,000,000,000,000. It may give a better conception of the amount of medusæ in this extent, if we calculate the length of time that would be requisite, with a certain number of persons,

for counting this number. Allowing that one person could count a million in seven days, which is barely possible, it would have required that 80,000 persons should have started at the creation of the world, to complete the enumeration at the present time, (1820.) (Account of the arctic regions. Vol. II. p. 179.

In examining the colouring matter of a yellowish green water, he found it to be animalcules—" Some advancing at the rate of $\frac{1}{180}$th of an inch in a second, others spining round with great celerity. But the progressive motion of the most active, however distinct and rapid, it appeared under a high magnifying power, did not in reality exceed an inch in three minutes. At this rate it would require one hundred and fifty-one days to travel a nautical mile. A condor, it is generally believed, could fly round the globe at the equator, in a week; these animalcules, in still water, would not accomplish the same in less than 8955 years.

The vastness of their numbers, and their exceeding minuteness are circumstances of uncommon interest. In a drop of water, examined by a power of 28,224 (magnified superfices) there were fifty in number, on an average, in each square of the micrometer glass, of $\frac{1}{840}$th of an inch in diameter: and as a drop occupied a circle on a pane of glass containing 529 of these squares, there must have been in this single drop of water, about 26,450 of these animalcules. Hence reckoning sixty drops to a dram, there would be in a gallon of water, a number exceeding by one half, the amount of the population of the whole globe. The diameter of the largest of these animalcules, was only $\frac{1}{2000}$th of an inch—and many only $\frac{1}{4000}$th of an inch. The army which Buonaparte led into Russia, in 1812, estimated at 500,000 men, would have extended, in a double row, or two men abreast, with two feet three inches for each pair of men, a distance of $106\frac{1}{2}$ English miles. The same number of these animalcules, arranged in a similar way, but touching each other, would only reach 5 feet $2\frac{1}{2}$ inches!

A whale requires a sea, an ocean to sport in: about 150,000,000 of these animalcules would have abundant room in a tumbler of water.

Extract from a Journal kept on board the Ship Hector, Capt. Gillander, on a passage from Liverpool to New-York, in Dec. 1819, *and Jan.* 1820. By J. V. R.

Date.	*Lat. No.*	*Long. W.*	*Temp. of air.*	*Temp. of water.*	
Dec. 1	52°·—	8°·20′	52	52	This had been the state of the air and water for several days;—we left Liverpool, Nov. 26th, but as there had been no variation in the Thermometer; its state is now first noted.
2	51°·36′	9·	52	51·½	
3	50°·50′	9·30	52	51	
4	49·56	10·	52	52	
5	48·32	11·	53	56	
6	47·16	15·42	53	57	
7	46·30	20·	54	57	
8	46·51	——	56	58	
9	——	——	57	58	No observation.
10	46·35	25·	61	59	
11	46·8	28·30	58	62	
12	45·16	31·30	58	61	
13	44·40	35·20	60	63	
14	——	——	62	63	No observation.
15	43·15	43·32	62	63	
16	43·1	——	63	66	At 8 A. M.
			55	64	At 10 A. M.
			53	52·½	At noon.
			52	50	At 4 P. M.
			50	46	At 8 P. M.
17	42·30	——	50	46	
18	41·51	54.	48·	45·½	
			56	63	At 4 P. M.
19	41·41	58·	45	56	
20	41·40	62·	47	49	
21	——	63·30	46	58	
22	——	——	50	68	
23	41·5		53	68	
24	——	——	62	70	No observation.
25			61	71	Do. Do.
25			54	57	Do. Do.
			36·½	54	
26	40·4	67·	38	58	
			44	50	
27	41	67·	44	46	
28	40·5	——	37	43	
			38	45	At 4 P. M.
29	39·18	——	39	58	
			40	59	At 4 P. M.
30	40·15	——	42	28·½	
31	——	——	41	30	No observation.
Jan. 1	——	——	40	27·½	Do. Do.
2	40.26	——	31·	40	
3	39·40	——	29	39	
4	——	——	30	40	Do. Do.
5	40·1	——	32	39	
6	——	——	29	40	
7	——	——	32	47	Entered the Bay of New-York.

Notes and observations made on board U. S. Ship Columbus, Commodore Bainbridge, on her passage from Gibraltar to Boston, June and July, 1821—*by* C. A. Davis.

	June and July 1821	Lat.	Lon. W.	Barom.	Ther. in air.	Ther. in water	*Winds, and state of the weather, &c. &c.*
☿	June 6	35·58	5·44	30· 7	71		E. N. E. fresh breeze, clear sky, left Bay of Gibraltar about 11 A. M.
♃	7	36·13	7·56	30· 8	73		N. N. W. light breeze, clear sky, smooth sea.
♀	8	35·48	10·02	30·12	66		N. strong, with thin clouds.
♄	9	36· 5	13·22	30·12	66		N. N. E. free breeze with some clouds.
☉	10	36·13	16·54	30·15	68		N. N. E. light with thin clouds.
☽	11	36· 8	19·16	30·16	69		E. light, sky partly clouded.
♂	12	36·14	20·43	30· 8	69		S. E. a free breeze, sky cloudy, with some rain.
☿	13	36·16	23· 7	29· 7	67		S. W. by W. light, with occasional squalls, cloudy with much rain—current S. E. by E. ½ E. ⅓ mile 15 hour.
♃	14	36·	25·54	30·18	66		N. N. E. fresh, flying clouds, variation of Compass 23° 55′ West.
♀	15	35·48	27·19	30·19	68	69	S. W. light, cloudy, very hazy.
♄	16	36·27	30· 7	30· 1	69	69	E. N. E. light, cloudy and hazy.
☉	17	36·19	32·44	30·14	69	69	E. S. E. a fine breeze, foggy and rain.
☽	18	35·41	32·46	30· 1	71	69	W. foggy and drizly rain, wind light and variable.
♂	19	35·34	33·23	29·92	71	69	Calm, broken clouds and hazy, quantity of Gulf-wind passing—outer edge of Gulf-stream.
☿	20	35·11	35·55	30· 5	69	72	N. by E. fine breeze, judged ourselves in the influence of the Gulf-Stream.
♃	21	35· 9	38·42	30·13	70	71	N. light, at 10 A. M. lon. by Sun, 39° 10′ 22″; 10′ 20″ E. of Chron'r.
♀	22	34·57	39·37	30·19	69	69	N. light, some clouds and hazy; morning Ther. 71° in air and water.

Continued.

June and July 1821		Lat.	Lon. W.	Barom.	Ther. in air.	Ther. in water.	*Winds, and state of the Weather, &c. &c.*
♏	June 23	34·39	40·28	30·19	71	72	S.W. by S. light, broken clouds, and clearing, quantity of Gulf-weed around us.
⊙	24	35· 3	42·51	29· 7	71	71	N. by W. fresh, cloudy and rain, increasing, and hawling to S. W.
☽	25	36·13	42·38	29· 7	71	70	W. by N. blowing fresh, with a heavy sea, ship labouring very much.
♂	26	35·42	42·33	29·75	70	68	W. N. W. fresh, cloudy, humid and frequent showers.
☿	27	34·40	42·53	29· 8	71	72	W. N. W. fresh, squally, humid and cloudy, towards eve. inclining to moderate.
♃	28	34·48	42·51	29·96	68½	71½	N. W. by W. light cloudy, sea falling.
♀	29	33·26	44·24	30·15	72	71½	W. N. W. light and variable, quantity of Gulf weed passing.
♏	30	34·20	45·14	30·16	74	72	S. W. by W. light, thin flying clouds inclining to humidity.
⊙	July 1	35·20	47· 4	29·95	73	70½	S. W. fresh breeze, rough sea, rainy and squally.
☽	2	35·45	47·58	30·17	70	70½	N. W. by W. light, and occasionally clear and agreeable.
♂	3	35· 8	48·36	30· 3	73	74	W. almost calm lon. ☽ ⊙ 48° 35′ 45″ ch'r 48° 47′ 52″.
☿	4	35·40	49·33	30·29	74	72	S. W. by W. light breezes, inclining to hazy; our Columbia's birth day, fully attended to.
♃	5	36·32	50·13	30·23	75	72	W. S. W. fresh and very humid, flying clouds, hazy with rain.
♀	6	36·23	51·34	30· 1	75	73	W. S. W. fresh and squally, cloudy and damp; supposed to be in counter current of Gulf-Stream.
♏	7	36· 5	52·11	29·85	74	73	S. W. by W. fresh and squally, cloudy and damp.
⊙	8	36· 2	54·31	29·98	72	73	N. E. fine breeze, flying clouds with frequent showers.
☽	9	36·41	57·42	30·	73	72	S. E. fresh, with a cloudy sky, and humid.
♂	10	36·52	59·50	29·95	73	74	W. light and squally, frequently shifting, and through the day changing round the compass.

Concluded.

June and July 1821		Lat.	Lon. W.	Barom.	Ther. in air.	Ther. in water.	*Winds, and state of the Weather, &c. &c.*
☿	11	36·23	60·33	30·	74	73	W. by N. light and squally, with rain.
♃	12	36·11	61·44	29·93	77	76	S. W. by W. variable and clear.
♀	13	36·32	62·47	30· 4	74	77	N. W. by W. light airs clear dry weather, with an agitated sea.
♄	14	37·14	63· 7	30· 1	73	77	E. N. E. light, in the Gulf-Stream, toward evening temp. of water 71 to 80.
☉	15	38·10	64·15	30·18	75	$80\frac{1}{2}$	N. N. E. light, thin clouds, hazy, inclining to clear.
☽	16	39·37	63·99	30· 3	75	76	E. light and sky hazy.
♂	17	41· 3	64·28	29·98	75	74	E. fine breeze, almost clear, temp. of water from 74 to 68 sounded in 100 fathoms, on St. George's bank.
☿	18	41·59	66·33	29·77	$64\frac{1}{2}$	58	S. S. W. fresh, cloudy, and rain, very gloomy, fell in with fishing boats.
♃	19	42·26	67·21	30· 1	64	60	W. S. W. light, a mackerel sky, accompanied by quantities of fish.
♀	20	42·21	6891.	30· 1	$65\frac{1}{2}$	63	S. S. W. cloudy and foggy, caught from daylight till 12 o'clock upwards of 12,000 mackerel.
♄	21	42·24	69·30	30· 8	$73\frac{1}{2}$	67	S. S. E. light breeze, saw the land ! ! ! Cape Cod.
☉	22						Arrived this morning off the light—came to anchor owing to fog in 31 fathoms, remained an hour, got under weigh, received a pilot at 11 A. M. at 3, past through the entrance to the harbor, struck the middle grounds and remained half an hour, got off and proceeded up to town, and came to anchor off Long Wharf about 5 P. M. after a passage from Gibraltar of 47 days.

Art. XVIII.—*Description of the Apparatus used in lighting the Tron steeple Glasgow, with Gas—see the plate.*

[Communicated to the Editor, by a gentleman in Glasgow.]

C is a lamp in which the gas is burned. Externally it is concealed by the figure of an eagle, internally it has a door containing five panes of glass, glazed convexly. Within the lamp, and behind the flame, the surface is covered with pieces of mirror plate so as to form a parabolic reflector, from which the rays diverge upon the dial plate of the clock D. At the top of the lamp is a funnel for the smoke.

A is the gas pipe by which the lamp is fed. It is at the same time the principal support of the lamp.

B is a flash pipe by which the lamp is lighted; and it acts at the same time as a bracket to strengthen the pipe A. This pipe is cut with cross apertures in the side at short distances from each other, extending from the body of the steeple to the burner. At figure second is a section of the flash pipe, showing the cuts in the side, and a covering which projects over them to protect them from rain. D fig. 2. shows a transverse section of the pipe and the covering. A and 2 show the cuts C, and the cover B.

After the gas has been let on by both pipes, a light is applied externally to the flash pipe, the gas rushing in jets through the apertures, kindles, and the flame communicating from one to another reaches the burner within the lamp. As soon as the gas passing through the burner is inflamed, the stop cock of the flash pipe is shut, the jets are of course extinguished, and the lamp continues to burn fed by the other pipe.

E and F are air-tight hinges in the two pipes, so contrived that by means of the chains G G, the lamp is drawn up by a person standing within the balcony of the steeple, beside H, the City Arms, *in alto relievo*, the burner, the glass, and the parabolic reflector, are thus cleaned every day, from the smoke or condensation of vapour which may have accumulated during the preceding night.

By the side of the pipes there is a good deal of scroll work acting as lateral brackets to strengthen them, which could not have been introduced into the drawing without confusing it.

The lamp is lighted every afternoon a few minutes before sun-set and at day-light the next morning it is extinguished by the machinery of the clock as represented in figure 3.

G is the main pipe by which gas is supplied to the lamp.

C is the stop cock, opened and shut by the lever B, at present open.

D is a wheel upon the spindle of the hour hand of the clock, making two revolutions in twenty four hours.

E a wheel moved by the other of double the diameter, and of course making one revolution in the same time.

H the beam of wood which supports these.

Upon the wheel E is a moveable index F, which is set about once a month, to correspond with the sun's rising. As the wheel revolves, a projecting knob at the end of this index, gradually reaches the upper end of the lever A, and presses it forward; this by moving disengages the lever of the stop cock B, which dropping downward by its own weight, falls into the position marked by the dotted lines I, and cutting off the supply of gas extinguishes the flame.

This plan of lighting steeples was the fruit of the joint labours of Messrs. J. & A. Harts and Mr. A. Liddell. The Messrs. Harts are operative bakers in Glasgow, who have distinguished themselves by their scientific attainments. Mr. Liddell is an ironmonger and his professional knowledge was found useful in the practical application of the plan. Messrs. Harts are found in their bake-house during the greater part of the day and their leisure hours are devoted to scientific and mechanical studies. They made the Camera Obscura in Glasgow Observatory, one of the largest in the kingdom, the speculum (a metallic one similar to those in Herschel's large Telescopes) about twelve inches in diameter, and the lens nearly as large were wholly prepared by themselves. They have in their bake-house a working model of the steam engine, (one of several, which they have constructed,) on a new plan which drives a turning lathe in the apartment above, and they have constructed a very superior reflecting telescope six feet in length. Lately they have made some curious discoveries in the art of staining glass. Their scientific knowledge is unaccompanied by the slightest degree of pride or ostentation, and they continue to labour as diligently at their trade as if they knew no higher pleasure.

ART. XIX.—*Longitude of New-York ascertained by he observations of* Prof. JAMES RENWICK.

Columbia College, New-York, Feb. 25th, 1822.

TO PROF. SILLIMAN.

Sir,

I beg leave to commuicate, for publication in your valuable journal, my observation of the Solar Eclipse of 27th August last.

The observation was made from the cupola of the College in latitude 40° 42,′ 45″, N, as deduced from a number of observations made by my colleague Dr. Adrain.

The instruments made use of were an Achromatic Telescope by Dollond of four feet focal distance, a box-chronometer by Wingham, (London) and a pocket-chronometer by Morrice, (London.) The rates of both time keepers had been carefully noted for some time previous, and their error was observed by means of transits of the sun on the preceding and following day. This part of the preparation was performed by Messrs. T. & B. Demilt, watch makers of this city, who have erected an observatory and provided themselves with a transit and an excellent astronomical clock.

With these instruments the times of beginning and end, were as follows, viz.

					days. hrs.
Beginning—Apparent time at New-York.					
	1821.	August.	-	- -	26.19.37′.32″
End	do.	do.	do.	do.	26.22.20′.58″

The morning was by no means favorable, I was in consequence prevented from taking a set of altitudes, that might have enabled me to state the time from my own observations.

The view of the beginning of the Eclipse was as favourable as I could have desired, the clouds cleared for a few minutes from the sun's face, and my preparatory projection was so far accurate as to enable me to have in the centre of the field of the telescope the exact point of impact.

With regard to the end, the clouds had by that time accumulated to such a degree as to compel me to remove the

dark glass from the telescope and I had to contend with alternations of partial observation and intense light.

From the above observation, by a cursory calculation for the accuracy of which I cannot fully vouch, I make the longitude of the Cupola of Columbia College 74.° 5.′ 11.″ or in time 4hrs. 56.′ 23.″ 4 W. from Greenwich. The mean of a number of Chronometers makes it about 74.° 8.′ W. and the Longitude given upon Eddy's Map is 74.° 0.′ 45.″ W.

I am Sir,

Your most obedient Servt.

JAS. RENWICK.

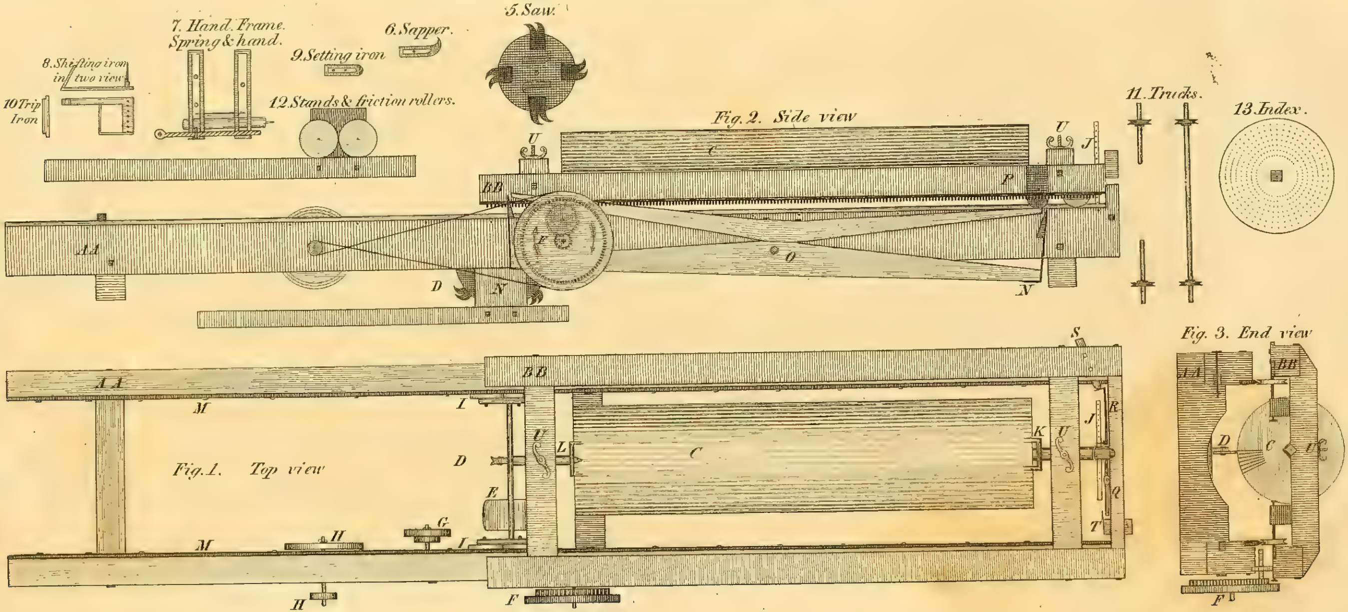
Art. XX.—*Notice of the Revolving Steam Engine; by* J. L. Sullivan, Esq.

Columbia, S. C. *March* 1, 1822.

Mr. Silliman—Sir,

Had I no other motive to offer you a further communication on *Morey's Steam Engine*, I should think it due to your Journal, in which an account of this form of the machine had been given to the public at an early period, to state the fact of its successful employment; but I find a farther reason for doing so in the opinion expressed by Ward in your 4th volume, while describing *his* invention. He fears that Morey's engine will not be durable, because, as he thinks, the friction between the parallel guides and the brasses that move on them, will be such, as to affect the parallelism of the piston-rod. This was to assume, that it would be impracticable to apply any anti friction substance to this part of the machine. But in practice, nothing was easier than to attach to each side an *oil-box*, with a few small holes in the top thereof, covered with a sponge, which as the engine revolves imbibes the oil, while the brass at each stroke reaches, and a little compresses this sponge, so that the steel guide pieces, are continually lubricated. And thus far it has performed satisfactorily, ascending the Santee and Congaree, towing heavy loads against a strong current. We call the steam boat, in which this engine operates the patent, in allusion to her claim, or right to navigate the waters of New-York, notwithstanding the monopoly granted by the

EASTMAN'S ROTARY SAWING MACHINE.



Eng.[d] by Reed, Stiles & Co.

state, it being an admitted point, that the laws of the United States are the paramount authority. Wherefore, patented operations cannot be legally excluded.

But Mr. Ward's apprehension is shewn to be unfounded, by the performance of an engine of this kind during the last three years, at a manufactory near Boston, even without this precaution.

Unwilling to occupy your pages with this familiar subject, I will only add, that it appears to have been the object of Mr. Watt's experiments, to *avoid the use of the crank* as involving the *necessity* of a fly-wheel, to which motion must be given, at some expense of power, at every stroke. If I am not mistaken, the double revolving engine, is effectively a rotary engine. It has no dead-point, and requires no fly-wheel; and it is so far different from those reciprocating engines, which work with a heavy beam, that the indispensable weight of the machine, has a degree of momentum, that contributes to the steadiness of its operation. It appears to me, that to produce the same effect, Mr. Ward must place two cylinders in each water wheel at right angles.

Since this occasion of addressing you occurs, permit me to avail myself of the opportunity, to describe a small improvement in the steam boiler, put in practice in this boat, to combine strength with horizontal extension, in order to offer a great proportional surface to the fire, and yet carry a light load of water.

I took the material, that would have made a boiler of eight feet diameter, seventeen feet long, and formed seven cylindrical vessels: having conical heads, terminating in flanches to which are attached, a cross connecting pipe, thus making one boiler of them. The steam rises from the centre of each into a common chamber, on which the safety valve, and throttle valve are situated. The support is from four semicircular irons, or arches, from which suspending irons descend, &c. The spaces between, are filled with brick. The flue passes under them above deck; its sides and floor are formed of water vessels, kept full by the surplusage of the supply pump, for which they prepare the water; under the grate, however, there is an air chamber formed of two thicknesses of sheet copper, the space between them being also supplied with water, this descends a few

feet into the hold, and its bottom forms a pan into which the cinders fall. The floor of the fire room is on this level, and being half above and half below the level of the deck, is open to the air.

When half full it contains about three hundred gallons, but the fire is in large proportion. The steam appears to form very quickly. The advantage of the conical head is, that instead of being the weakest, this is the strongest part of the boiler, and within rules of computation.

I am respectfully yours.

J. L. SULLIVAN.

ART. XXI—*Description of an improved Saw machine with sectional teeth for the purpose of manufacturing staves, heading, and siding; with remarks on the machine, and the lumber manufactured by it; by* ROBERT EASTMAN, *of Brunswick, Maine.*

Communicated by Professor Cleaveland, of Bowdoin College.

THIS machine consists of a frame about twenty four feet in length, and five in breadth; and a carriage about twelve feet in length, and four in breadth. The carriage travèls with iron trucks, grooved on their circumferences, which run upon iron slides bolted to the inner sides of the frame. An iron centre passes through one end of the carriage, and into the end of the log, and is one of the centres, on which it revolves. At the other end of the carriage, *where there are two cross pieces*, is an iron arbor, which receives the circular iron index with concentric circles of holes drilled at equal distances and corresponding to the different sizes of the logs to be manufactured into staves, heading, or siding. These holes are called the numbers of the index. On the end of the index arbor, inside of the carriage, is a square to receive a dog fitted to it, which is first driven into the end of the log, and then slipped on the square of the index arbor, by means whereof the index and log are firmly connected together, and both revolve on the index arbor and centre, which are kept in place by stirrup screws.

Near the middle of the frame is the main shaft, which is of cast iron, and runs on friction rollers, supported by stands

on the floor. On this shaft are the saw and sappers, which are firmly attached to it with screws. The sappers which are crooked pieces of iron, *steel edged*, with slits to set them at a greater or less distance from the centre, according to the width of the lumber to be manufactured, and partaking of a common motion with the saw *only at a less distance from the centre*, cut the sap off the log leaving the thick or outer edges of the lumber perfectly straight.

A band, passing round the main pully, which is on the main shaft, and on a drum that runs under it, (*which may be driven by a horse, steam, or water power*,) gives motion to the saw, and sets the machine in operation. The saw has only section teeth, and is made of a circular piece of sheet iron or steel, about one eighth of an inch in thickness, containing usually but eight teeth which are set in the outer edge of the saw plate,being dove tailed and grooved in order to remain firm until worn out, when new ones may be set in the same plate.

Under the frame is a small shaft with a large pulley on it (inside of the frame) which is connected to the main shaft by a band ; on the other end of this small shaft at the outside of the frame, is another small pulley, which is also connected by a band to the *feed pulley*, which is placed near the middle of the frame. On the inside face of this *feed pulley*, are two wheels ; one of them containing eight cogs, is placed in the centre ; the other, a squirrel wheel, contains fifty cogs on the inside of its rim pointing towards the centre. Another short shaft, containiug two wheels of about eighteen cogs each, is placed near the middle of the frame ; one of these wheels mashes into the rack under the carriage ; the other is placed on the outer end of the shaft to be acted upon by the large and small wheels that are on the feed pulley, which causes the carriage to feed and return alternately by the different acting of the eight and fifty cog wheels on the 18 cog wheel, which not only reverses the motion, but, at the same time, gives a different speed to the travel of the carriage, in its feeding and returning. Thus, when the 8 cog wheel mashes into the 18 cog wheel, the carriage moves forward with a slow motion to feed the saw ; when the cut is performed, the feed pully with its contents drops, unmashes the 8 and mashes the 50 into the 18 cog wheel, which reverses and quickens the travel of the carriage in returning, as 50 is to 8. This motion of the ris-

ing and falling of the feed pully, is effected by a lever with a small steel spring at each end of it; each spring has a catch to lock on a pin in the side of the frame, to hold the cog wheels in their mash. when the carriage is feeding and returning. In the centre of the lever is a pin, which attaches it to the side of the frame, and is the fulcrum on which it works. On the top of this lever, are two wooden springs, which run from the centre to the end, a little rising, which forms an inclined plane.

A knob on the side of the carriage acts on the top of this wooden spring as the carriage is feeding and returning, and alternately unlocks the steel spring from the pin in the frame; and the wooden spring causes that end of the lever, where the knob is, to descend and the other to ascend and locks its steel spring on the pin in the frame again. The piece of wood, which contains the feed pulley, is attached to that end of the lever which comes at the middle of the frame, and causes it to ascend or descend at every travel of the carriage. An iron frame is bolted firm on the end cross piece of the carriage, which holds an iron hand with a steel pointer in it, which, by means of a steel spring, locks into the holes of the index, and keeps the log firm in its place, while the saw is performing its cut.

On the inside of the end cross piece of the frame, is a shifting iron, which is a horizontal bar of iron with an elbow, forming an acute angle on the outer end; on the inner end is another elbow, which turns down, forming a right angle, with a bar perforated with holes at suitable distances, to correspond with the numbers of the index; into the holes in the bar a steel pointer 7 or 8 inches in length, may be screwed, so as to enter the holes of the index. This iron can move horizontally, being supported with hook bolts, and is kept in place by a small spring acting on the inner end; and two guard screws, are set, so as to guide the large pointer into one of the holes of the index when the carriage and log return from the cut.

On the other side of the frame, where the outer end of the hand on the carriage passes is a small trip iron, that strikes on the outer end of the hand and unlocks its pointer from the index; at the same time, the large pointer, entering one of the holes of the index and the carriage, striking the acute angle of the shifting iron, give it a hor-

izontal motion inward, which causes the log and index to shift one number, when the shifting iron strikes the guard screw, *that* prevents its shifting more than one number at a time. The outer end of the hand being now relieved from the trip iron, its pointer enters a new hole of the index by means of the spring and the carriage again moves forward for another cut.

Thus it operates, without any aid except the power that drives it, until it cuts a tier of lumber entirely around the log, like the radii of a circle, leaving their thin edges attached to it. These are then taken off, and another tier cut in the same manner, that is, when the log is large enough to admit of two tiers.

References to the Plate.

Fig. 1. gives a top view of the machine with the log in it ready for working.
2. gives a side view of the same.
3. an end view of the same with a log as partly cut.

5. The Saw.
6. The Sapper.
7. The Hand-frame Spring and Hand.
8. The Shifting iron in two views.
9. The Setting iron.
10. The Trip iron.
11. The Trucks.
12. The Stands.
13. The Index.

Reference to the several Parts as put together.

AA. The Frame, which is made of timber about 8 by 14 inches and put together by screws.
BB. The Carriage, made of timber about 7 by 8 inches, put together by screws.
C. The Log as dogged and put into the machine.
D. Saw and Sappers.
E. Main Pulley and Shaft.
F. Feed Pulley and Shifting gear, which is connected to the rack, under the carriage.
G. Tightening Pulleys.
HH. Regulating Pulleys and Shaft.
I I. Friction Rollers and Stands.
J. Index.

K. Index, Shaft and Cog.
L. Centre iron and Cog.
MM. Iron Slides bolted to the sides of the frame for the trucks to travel upon.
NN. Revolving Lever and Springs.
O. Pin, which attaches the Lever to the sides of the frame, and is the Fulcrum on which it works.
P. Knob on the side of the carriage, that works the shifting lever.
Q. Hand-frame, Spring and Hand.
R. Shifting Iron and Long Pointer.
S. Setting iron, which is Bolted to the under side of the carriage, and strikes the acute angle of the Shifting iron, when the carriage returns to set.
T. Trip Iron, which unlocks the hand from the Index, when the carriage returns to set.
UU. Stirrup Screws.

Remarks, &c.

This machine furnishes a new method of manufacturing lumber for various useful purposes. Though the circular saw had previously been in operation in this country, and in Europe, for cutting small stuff, it had not, within the knowledge of the writer, been successfully applied to solids of great depth; to effect which the use of section teeth are almost indispensable.

In my first attempts to employ the circular saw for the purpose of manufacturing clap boards, I used one nearly full of teeth, for cutting five or six inches in depth into fine logs. The operation required a degree of power almost impossible to be obtained with the use of a band; the heat caused the plate to expand, and the saw to warp, or, as it is termed, to get out of true. To obviate these difficulties I had recourse to the use of section teeth, and the improvement completely succeeded. The power required to perform a given quantity of work by the other method, was, by this, diminished at least three quarters. The work, formerly performed by 70 or 80 teeth, was by the last method performed by 8 teeth; the saw dust, which before had been reduced to the fineness of meal, was coarser, but the surface of the lumber much smoother, than when cut with the full teethed saw.

The teeth are made in the form of a Hawk's bill, and cut the log up, or from the circumference to the centre.

The saw may be carried by an eight inch band, when driven a proper speed, (which is from ten to twelve hundred times per minute,) will cut nine or ten inches in depth into the hardest white oak timber with the greatest ease. The sappers at the same time cut off from one to two inches of the sap, and straighten the thick edges of the lumber.

The facility with which this saw will cut into such hard materials may be supposed to result from the well established principle that where two substances in motion come in contact, their respective action on each other is in direct proportion to their respective velocities; thus, a circular plate of iron, put into a quick rotary motion, will with great ease penetrate hardened steel, or cut off a file, when applied to its circumference; and the same principle is applicable to a rotary saw for cutting wood. The requisite degree of velocity is obtained by the continuous motion of the circular saw; by which also it has greatly the advantage of one that has but a slow motion on account of dulling, as the teeth are but little affected, and being only eight in number, but a few moments labour is required to sharpen them. If the velocity of the saw were slackened to a speed of but 40 or 50 times per minute, it would require at least four such bands to carry it through a log as above described.

One machine will cut from 18 to 20 hundred square feet of pine timber per day, and two of them may be driven by a common tub wheel 7 or 8 feet in diameter, having 6 or 7 feet head of water, with a cog wheel, and trundle head so highly geared, as to give a quick motion to the drums, which should be about four feet in diameter. The machine is so constructed, as to manufacture lumber from 4 to 10 feet in length, and from two to ten inches in width, and of any required thickness.

It has been introduced into most of the New England states, snd has given perfect satisfaction. The superiority of the lumber has for three years past been sufficiently proved in this town (Brunswick, Me.) where there have been annually erected from fifteen to twenty wooden buildings, and for covering the walls of which, this kind has been almost universally used. The principal cause of its superiority to mill sawed lumber, is in the manner in which it is manufactured, viz.: in being cut towards the the centre of the log, like the radii of a circle; this leaves the lumber feather

edged in the exact shape in which it should be, to set close on a building, and is the only way of the grain, in which weather boards of any kind can be manufactured to withstand the influence of the weather, without shrinking, swelling, or warping off the building. Staves, and heading also, must be rived the same way of the grain in order to pass inspection. The mill sawed lumber, which, I believe, is now universally used in the middle and southern states, and in the West-Indies, for covering the walls of wooden buildings is partly cut in a wrong direction of the grain, which is the cause of its cracking and warping off, and of the early decay of the buildings by the admission of moisture. That such is the operation may be inferred by examining a stick of timber which has been exposed to the weather: the cracks, caused by its shrinking all tend towards the heart or centre, which proves that the shrinking is directly the other way of the grain. It follows that lumber cut through or across the cracks would not stand the weather in a sound state in any degree to be compared with that which is cut in the same direction with them. I have no hesitation in stating that one half the quantity of lumber. manufactured in this way, will cover, and keep tight and sound the same number of buildings for an hundred years, that is now used and consumed in fifty years. Add to this the reduction of expense in transportation, and of labour in putting it on, and I think every one must be convinced, that the lumber manufactured in this improved way is entitled to the preference.

In manufacturing staves and heading, a great saving is made in the timber, particularly as to heading, of which at least double the quantity may be obtained by this mode of sawing to what can be procured in the common method of riving it; nor is the straight grained, or good rift indispensable for the saw, as it is for the purpose of being rived. The heading, when sawed, is in the form it should be, before it is rounded and dowelled together, all the dressing required, being merely to smooth off the outsides with a plane. Timber for staves ought to be straight in order to truss, but may be manufactured so exact in size as to require but little labour to fit them for setting up.

Both articles are much lighter for transportation, being nearly divested of superfluous timber, and may be cut to any thickness required for either pipes, hogsheads, or flour barrels.

Brunswick, Me. April 4, 1822.

Art. XXII.—*Formation of flexible, elastic tubes; by* Mr. Thomas Skidmore.

FOR THE JOURNAL OF SCIENCE.

Mr. Editor,

I have lately had occasion, in the practice of the arts, to make use in a modified manner, of the compound blowpipe of Hare, supplied with oxygen and hydrogen gases; and in doing so, have been compelled to seek for some material of which I could make a flexible elastic hose or tube, indispensable to my operations.

Leather in various ways, was used without success. The intestine of the hog, and the bullock—in their natural state, answered a tolerable purpose, for a short time, but they soon cracked and exhibited fissures, through which the gasses escaped very fast—and on being tanned with an infusion of sumach, became very porous, notwithstanding they were surcharged with oils, tallow, &c.

At last I imagined that caoutchouc, or India rubber, might be employed with a prospect of success; and as I obtained it, I trust it may possibly be of some importance to some of your readers, to be made acquainted with the process, I pursued in its manufacture—the detail of which follows and is at your disposal.

I caused small iron wire to be coiled spirally around a cylindrical rod of iron, as close as it could be laid, of the length, in one instance of twelve feet. The extremities of this spiral coil were then made fast to the rod, (after having been once loosened from it) in manner, such, that, in the subsequent operations, the convolutions of the wire should remain in contact with each other. Over this spiral coil was wound in a similar manner, a covering of tape, ferreting, or other fabric, so as to completely invest it, and, in a process which is shortly to follow, to prevent the intrusion of the gum to be used, into the cavity of the spiral coil before mentioned.

The rubber is now taken, I mean such kind of it as is sold in the form of bottles, and cut into long, narrow strips, like carpet rags. This is best effected by cutting them originally into two equal parts, and then reducing them, as near as may be, into the shape of a circular plate, with a pair of sharp tailor's shears, which succeeds in such case

much better than would commonly be imagined. These strips are wound over the covering of tape, or ferreting above mentioned, in a spiral manner from one end of the coil to the other, and this, in my instance was twice repeated—care being taken to lay, as far as practicable, the fresh cut surfaces in contact with each other, drawing them so tightly, as to cause them, from their elastic property, to stretch to two, three or four times, their ordinary length. When this was done, another covering of strong tape (linen is to be preferred) was laid likewise spirally over, or around the same from end to end—and secured upon it, by very strong twine laid as closely as could be done, and drawn as tightly as the material would permit. The rod of iron was next withdrawn—the recently formed hose was then so far bent into a circular form as to be received into a vessel of water in which it was boiled for an hour or two, when it was taken out, the external covering taken off, and the internal wire and tape withdrawn.

This latter operation, at first gave me some trouble, in consequence of the stiffness of the wire—but, in preparing other tubes of the kind, this difficulty was overcome by annealing the wire, previous to commencing operations.

In the course of my little practice in pursuit of this object, I found that if the hose so prepared, be, for any purpose subjected to a second boiling, it has the effect of reducing the size of the hose considerably, so that if this second boiling be even intended, though I know of no reason to desire it unless it be to unite two pieces of hose together, this circumstance should be taken into the account.

I know very well that hose or tubes, of this material, made upon glass or metal rods, are stated to have been fabricated—yet as I was unable to succeed in that way in specimens exceeding four inches in length, I concluded, that where twice or thrice that number of feet were wanted, the method was impracticable, and therefore pursued the one I have detailed. It resulted in a hose, perfectly elastic, as you may well conceive, and though not very elegant on its exterior, yet very light, and perfectly impervious to the gases it conducts to the blow-pipe to which it is attached.* I am, Sir, yours, &c.

THOS. SKIDMORE.

* Note—A specimen of the tube is in our possession, and perfectly answers the description.—[*Ed.*]

Art. XXIII.—*Notice of a singular impression in sand stone,** *by* Mr. Isaac Lea.

Philadelphia, Feb. 24, 1822.

PROFESSOR SILLIMAN.

Dear Sir,

On looking over my port folio a few days since, I found a drawing of some reliquia which I made a few years since, when I observed them about a quarter of a mile above Pittsburgh, and on the same side of the Monongahela.

With this I send you a copy of the drawing, which you will please to insert in the Journal of Science, if you think it worthy of a place in that useful work. I am more anxious to see this figure in a permanent place, as on a late visit to it I found the dilapidating hammer of the quarry-man, to be likely to remove from its native bed, and destroy one of the most singular specimens of the kind which I have ever seen, and respecting which, the learned find so much difficulty in deciding whether it belongs to the animal or vegetable kingdom.

The impression is very perfect on a sand stone rock, and entirely flat. The base is perfectly terminated in the rock and is about six inches across; its length three feet, and terminated by a fracture of the rock, which leaves it doubtful how long it may have been in its pristine state; at this fracture it is four inches broad. The two lines are distinct in both lozenge shaped impressions, which are represented of the natural size in fig. 2d. [See the plate at the end.]

The hill in which it exists is not sufficiently high to take in the bed of coal pervading the neighbouring hills in a horizontal stratum about two hundred and fifty feet above this locality. In fragments of the same rock, are found many impressions resembling culmiferous plants, the joints of which are perfect. Some of them are now in my own collection, others I deposited, particularly a large one, in the "Academy of Natural Science."

Your obedient servant,

ISAAC LEA.

* Note—This article should in strictness, have been placed under the Geology, &c. but having been accidentally omitted, is inserted here.

Art. XXIV.—*On the twinkling of the Fixed Stars.*

New-Haven, January 20, 1822.

Mr. Silliman,

Sir,

In perusing Bonnycastle's Introduction to Astronomy, I was struck with the following solution of the phenomenon of the scintillation, or twinkling of the fixed stars. Page 42d, he says, "the fixed stars are distinguished from the planets by being more bright and luminous, and by continually exhibiting that appearance which is called the scintillation or twinkling of the stars. This probably arises from their appearing so extremely small, that the interposition of any minute substance, of which there are many constantly floating in the atmosphere, deprives us of the sight of them; but as the interposed body soon changes its place, we again see the star; and this succession being perpetual occasions the twinkling." Whether this be the commonly received opinion, on this subject, among astronomers, or not, I am not sufficiently conversant with their works to decide; but from its being assigned by so distinguished an astronomer as Mr. Bonnycastle, I conclude that it is one of the best that have been given. To my mind this solution is very unsatisfactory. Without farther proof of the fact, the existence of these floating substances in numbers, and of size sufficient to produce this phenomenon, is scarcely credible. But admit that they exist, why do they not produce similar phenomena in their transits over the faces of the planets? Farther, I apprehend that the effect of the interposition of these substances between the eye and the stars, which would be as Mr. B. observes, to deprive us of the sight of them, does not accord with the fact, or with the phenomenon of scintillation. In my view, the star does not disappear in its scintillations, but is constantly visible; and its twinkling seems to be the effect of successive emanations of light; resembling the waving of a blaze by the wind. Though but a novice in astronomy, I will suggest a conjecture on this subject, which, to my mind, is much more plausible; certainly less embarrassed with objections

than Mr. Bonnycastle's. It is supposed by astronomers, from the immense distances of the fixed stars, and the weakness of borrowed light, that they shine with their own light. May it not be owing to this fact, that they scintillate, or twinkle? would not their shining with their own light produce the difference, manifest in the appearance between them and the planets, which are known to shine with borrowed light? I am not able to point out with precision the difference between original, if I may so call it, and reflected light; but that there is a difference is very obvious. When looking at the sun with the naked eye, I can easily conceive, that were that body, which now, with its dazzling scintillations, compels me soon to turn away, removed at a suitable distance, it would exhibit to us the same phenomenon, as is now exhibited by one of the fixed stars. This subject is of some importance in connexion with the sublime idea that the fixed stars are suns to other systems, and I make the suggestion, with the hope that, if it be worthy of notice, it will receive a more satisfactory elucidation from an abler pen.

SCINTILLA.

MISCELLANEOUS.

Art. XXV.—*Original letters from Dr. Franklin, to the Rev. Jared Elliot of Killingworth, Con. concluded from Vol. IV. p. 357.*

6 Philadelphia, Dec. 10, 1751.

Dear Sir,

The Rector of our Academy, Mr. Martin, came over into this country on a scheme for making potash, in the Russian method. He promised me some written directions for you, which expecting daily, I delayed writing, and now he lies dangerously ill of a kind of quinsy. The surgeons have been obliged to open his wind-pipe, and introduce a leaden pipe for him to breathe through. I fear he will not recover.

I thank you for the merino wool; 'tis a curiosity. Mr. Roberts promises me some observations in husbandry for you. It is one Mr. Martin that makes dung of leaves, and not Mr. Roberts: I hope to get the particulars from him soon.

I have a letter from Mr. Collinson of July 19, in which he writes, "Pray has Mr. Elliot published any addition to his work; I have No. 1 and 2. If I can get ready, I will send some improvements made in the sandy parts of the County of Norfolk; by the way *it is a great secret*, but it is Mr. Jackson's own drawing up, being experiments made on some of his father's estates in that County: but his name must not be mentioned. I thank you for the fowl meadow grass. I sowed it June 7, as soon as I received it, but none is yet come up. I dont know how it is, but I never could raise any of your native grasses; and I have had variety of J. Bartram of curious species."

In another of Sept. 26, he says, "I am much obliged to thee for Mr. Elliot's third essay. I have sent Maxwell's select transactions in husbandry: if Mr. Elliot has not seen them, they may be very useful to him. I have prevailed on our worthy, learned, and ingenious friend, Mr. Jackson, to give some dissertations on the husbandry of Norfolk, believing it may be very serviceable to the Colonies. He has great opportunities of doing this, being a gentleman of leisure and fortune, being the only son whose father has great riches and possessions, and resides every year all the long vacation at his father's seat in Norfolk. After J. Bartram has perused it, I shall submit how it may be further disposed of, only our friend Elliot should see it soon; for Mr. Jackson admires his little tracts of husbandry as well as myself, and it may be of greater service to him and his Colony, than to yours." The fowl meadow grass has at last made its appearance. Another year we shall judge better of it."—Thus far friend Collinson, you may expect the papers in a post or two. If you make any use of them, you will take care not to mention any thing of the author.

The bearer is my son, who desired an opportunity of paying his respects to you in his return from Boston. He went by sea.

They have printed all my electrical essays in England, and sent me a few copies, of which I design to send you one per next post, after having corrected a few errata.

I am, dear Sir,

Your most humble servant,

B. FRANKLIN.

Mr. Martin is dead!

7 PHILADELPHIA, Dec. 24, 1751.

Dear Sir,

I wrote you at large per my son, in answer to your former favours, and sent you an extract of Mr. Collinson's letter, who much admires your tracts on husbandry. Herewith you will receive a manuscript of a friend of Mr. Collinson's, and a printed book; which you may keep till spring, and then return to me. I believe they will afford you pleasure.

I send you also enclosed a letter from my friend John Bartram, whose journal you have read. He corresponds with several of the greatest naturalists in Europe, and will be proud of an acquaintance with you. I make no apologies for introducing him to you; for though a plain illiterate man, you will find he has merit. And since for want of skill in agriculture, I cannot converse with you pertinently on that valuable subject, I am pleased that I have procured you two correspondents who can.

I am glad you have introduced English declamation into your College. It will be of great service to the youth, especially if care is taken to form their pronunciation on the best models. Mr. Whittelsey who was lately here will tell you, that we have little boys under seven, who can deliver an oration with more propriety than most preachers. 'Tis a matter that has been too much neglected.

I am, dear Sir,

Yours affectionately,

B. FRANKLIN.

8 PHILADELPHIA, Feb. 11, 1752.

Dear Sir,

I received your favour per my son, and return my thanks for your kind entertainment of him at your house. I delivered yours to my friend Bartram, and enclose you his answer; he is much pleased with the prospect of a continued correspondence with you: is a man of no letters, but a curious observer of nature.

I like very well the paragraph you propose to insert concerning Mr. Jackson's papers; except the last line, to wit, *the improvement of it must be deferred till another year;* instead of which, I would say, *it cannot now be inserted but shall be in our next.* My reasons are, that I think in the first place, your essays ought to be more frequent than once a year; next, that 'tis pity, if Mr. Jackson's papers would be advantageous to the public, a whole year's benefit of them should be lost; thirdly, I think he will be at a loss to know why, since your essay was not quite finished and published, his papers might not as well have been added now; and indeed I think you had best add them, unless you intend speedily another essay. Lastly, I object to the word *improvement*, which in the sense you use it is peculiar to New-England, and will not be understood elsewhere. It will look as if you proposed to alter it for the better, correct or amend it, such being the common meaning of the word *improve*. Every Colony has some peculiar expressions, familiar to its own people, but strange and unintelligible to others. But this is not to be wondered at, since the same may be observed in the different Counties of England. I know you will excuse this freedom, and that I need make no apology for it.

I am, with great respect, dear Sir,
Your most humble servant,
B. FRANKLIN.

9 PHILADELPHIA, Dec. 19, 1752.

Dear Sir,

I received your affectionate letter of the 1st. and am surprised to find that my letters do not of late get to your hand. I do not keep copies, but I remember well, that in one I

acknowledged the receipt of the select transactions, and in another I complained of the long delay of your fourth Essay, and desired that if Mr. Green would not do it, you would send it to me, and it should be despatched in a trice. To this I own I have long wondered that there came no answer; but now the reason appears you never received it. I am not indeed the most punctual of correspondents, but am however less negligent than I have of late appeared to you to be. To converse in this manner with my friends is one of my greatest pleasures; but much business does sometimes interfere and occasion delays, which makes me more ready to excuse others, as I have frequent occasion to be excused. At present however, I am not to be blamed, but some defect in the conveyance, which I cannot now guess at; but to prevent the miscarriage of this, I send it under cover to Dr. Johnson, and request him to forward it by some safe hand, for having exchanged many letters lately with that gentleman on occasion of my printing his book, and not observing any of them to miscarry, I have reason to expect this will at least get safe as far as Stratford.—By the way, are you not a letter in debt to our friend Bartram? If not I fear a long one of his to you, enclosed in one of mine has miscarried also.

Our friend Mr. Jackson wrote to me last year, for an account of the number of Palatines imported here within ten years, which I accordingly sent him, and accompanyed it with a sheet or two on the subject of peopling of countries, propagation of mankind, &c. in answer to which I have lately received a long and curious letter from him, which I will send for your perusal together with my paper, as soon as I find it can be done without danger of being lost.

In the mean time, I send you a meterological paper of mine, wrote in order to digest and methodise a few of my own thoughts, and to procure the corrections of my Friends, I beg your sentiments and criticisms, on such parts as you find wrong; and if you can give me any light into the nature of those meteors we commonly call *falling stars*, pray do; for I am extremely at a loss to know what to think of them. Also any thing that has come to your knowledge of the nature and effects of whirl-winds and water-spouts; concerning which I have seen only imperfect accounts.

I know you will be pleased to hear that our Academy flourishes, and therefore I inform you that we have now

upwards of 300 scholars in all the schools. Our Hospital too, goes on very well, and does much good. We have this day been opening our cargo of choice Drugs and Medicines from London, that cost us 112£ sterling; and find all in good order. I must not omit to acquaint you with one other instance of the public spirit of this people. A person who had been in the last expedition to discover a north-west passage, being fully persuaded from some observations he made, and notices he obtained there, that such a passage there probably is, wrote to me from Maryland, requesting I would endeavor to procure subscriptions here for another attempt. It is accordingly done; 1000£ is raised for the purpose, and a vessel is actually fitting for him to proceed in early in the Spring. If you have any queries to make concerning that Country, its Productions, &c. or would have any particular observations made there; write them, and I will send them by our captain who is an ingenious and observing man.

Did you receive the votes of our last years Assembly, which I sent you, as I think; but am not very certain. I know I intended it.

And now my paper will only afford me room to add, that I have not received more pleasure and satisfaction from any correspondence I maintain, than from that you have favoured me with; which I hope will never again meet such interruption, as I am, with sincere esteem and affection, dear Sir, your obliged friend and servant,

B. FRANKLIN.

10 PHILADELPHIA, April 12, 1753.

Dear Sir,

I received your favor of March 26, and thank you for comunicating to me the very ingenious letter from your friend Mr. Todd, with whom, if it may be agreeable to him, I would gladly entertain a correspondence. I shall consider his objections till next post.

I thank you also for the hint concerning the word *adhesion*, which should be defined. When I speak of particles of water *adhering* to particles of air, I mean not a firm adhesion, but a loose one, like that of a drop of water to the end of an icicle before freezing. The firm adhesion is after it is frozen.

I conceive that the original constituent particles of water are perfectly *hard*, *round* and *smooth*. If so, there must be interstices, and yet the mass incompressible. A box filled with small shot, has many interstices, and the shot may be compressed, because they are not perfectly, hard. If they were, the interstices would remain the same, notwithstanding the greatest pressure, and would admit sand, &c. as water admits salt.

Our vessel, named the Argo, is gone for the north-west passage; and the Capt. has borrowed my journals of the last voyage, except one Vol. broken set, which I send you. I enclose a letter from our friend Mr. Collinson: and am promised some speltz which I shall send per next post.

The Tatler tells us of a girl who was observed to grow suddenly proud, and none could guess the reason, till it came to be known that she had got on a pair of new silk garters. Lest you should be puzzled to guess the cause when you observe any thing of the kind in me, I think I will not hide my new garters under my petticoats, but take the freedom to show them to you, in a paragraph of our friend Collinson's last letter, viz.—But I ought to mortify, and not indulge this vanity.—I will not transcribe the paragraph.—Yet I cannot forbear.—"If any of thy friends (says Peter,) "should take notice that thy head is held a little higher up than formerly, let them know; when the Grand Monarch of France strictly commands the Abbe' Mazeas to write a letter in the politest terms to the Royal Society, to return the king's thanks and compliments in an express manner, to Mr. Franklin of Philadelphia, for the useful discoveries in Electricity, and application of the pointed rods to prevent the terrible effects of thunder storms: I say after all this, is not some allowance to be made if the crest is a little elevated. There are four letters containing very curious experiments on thy doctrine of Points and its verification, which will be printed in the New Translations. I think now I have stuck a feather in thy cap, and I may be allowed to conclude in wishing thee long to wear it.

Thine P. COLLINSON."

On reconsidering this paragraph, I fear I have not so much reason to be proud as the girl had; for a feather in the cap, is not so useful a thing, or so serviceable to the wearer, as a pair of good silk garters. The pride of man is very differ-

ently gratified, and had his majesty sent me a Marshall's staff, I think I should scarce have been so proud of it as I am of your esteem, and of subscribing myself with sincerity, dear Sir, Your affectionate friend, and humble servant,

B. FRANKLIN.

11 PHILADELPHIA, May 3, 1753.

Dear Sir,

I received your essay last post, and my presses being at present engaged in some public work that will not admit of delay, I have engaged Mr. Parker to print it out of hand at New-York. You may expect to see it done in two or three weeks. The pacquet was not sealed, and I observed that the tables showing the culture of sundry fields were not with the rest of Mr. Jackson's papers. Perhaps you did not design them for the press.

I wish the Barbary barley may grow. I have some of it and sowed it; but it seemed to me to have been cut too green. I have formerly heard it reckoned the finest barley in the world, and that it makes a great part of the food of the inhabitants.

I think I have never been more hurried in business than at present; yet I will steal a few minutes, to make an observation or two on Mr. Todd's ingenious letter to you.

1. The supposing a mutual attraction between the particles of water and air, does not seem to me to be introducing a new law of nature; such attractions taking place in many other known instances.

2. Water is specifically eight hundred and fifty times heavier than air. To render a bubble of water then specifically lighter than air, it seems to me that it must take up more than eight hundred and fifty times the space it did before it formed the bubble; and within the bubble should be either a vacuum, or air rarified more than eight hundred and fifty times. If a vacuum, would not the bubble be immediately crushed by the weight of the atmosphere? And no heat we know of will rarify the air any thing near so much; much less the common heat of the sun, or that of friction by the dashing on the surface of the water. Be-

sides, water agitated ever so violently produces no heat, as has been found by accurate experiments.

3. A hollow sphere of lead, has a firmness and consistency in it, that a hollow sphere of fluid unfrozen water cannot be supposed to have. The lead may support the pressure of the water 'tis immerged in, but the bubble could not support the pressure of the air if empty within.

4. Was ever a visible bubble seen to rise in air? I have made many when a boy with soap suds, and a tobacco pipe; but they all descended when loose from the pipe, though slowly, the air impeding their motion. They may indeed be forced up by a wind from below, but do not rise of themselves though filled with warm breath.

5. The objection relating to our breathing moist air, seems weighty, and must be farther considered. The air that has been breathed has doubtless acquired an addition of the perspirable matter, which nature intends to free the body from, and which would be pernicious if retained, or returned into the blood. Such air then may become unfit for respiration, as well for that reason, as on account of its moisture. Yet I should be glad to learn by some accurate experiment, whether a draft of air two or three times inspired and expired, (perhaps in a bladder) has, or has not acquired more moisture than our common air in the dampest weather.

As to the precipitation of water in the air we breathe, perhaps it is not always a mark of that air's being overloaded. In the region of the clouds, indeed, the air must be overloaded (its coldness considered) if it lets fall its water in drops, which we call rain; but those drops may fall through a dryer air near the earth; and accordingly we find, that the hygroscope sometimes shows a less degree of moisture during a shower, than at other times when it does not rain at all. The dewy dampness that settles on the insides of our walls and on our wainscots, seems more certainly to denote an air overloaded with moisture, and yet this is no sure sign. For after a long continued cold season, if the air grow suddenly warm, the walls, &c. continuing their coldness longer, will for some time condense the moisture of such air, 'till they grow equally warm; and then they condense no more, although the air is not become dryer. And on the other hand, after a warm spell, if the air grow cold, though moister than before, the dew is not

so apt to gather on the warm walls. A tankard of cold water, will, in a hot and dry summer's day, collect a dew on its outside. A tankard of hot water will collect none in the moistest weather.

6. 'Tis, I think, a mistake, that the trade winds blow only in the afternoon. They blow all day, and all night, and all the year round, except in some particular places. The southerly sea breezes on your coast indeed blow chiefly in the afternoon. In the very long run from the west side of America, to Guam among the Philippine islands, ships seldom have occasion to hand their sails, and yet they make it in about sixty days, which could not be if the wind blew only in the afternoon.

7. That really *is*, which the gentleman justly supposes *ought* to be on my hypothesis. In sailing southward, when you first enter the trade wind, you find it N. E. or thereabouts, and it gradually grows more east as you approach the line. The same observation is made of its changing from S. E. to E. gradually, as you come from the south latitudes to the equator.

I have not yet had time to transcribe my paper on the increase of mankind, but hope to do it shortly, and shall be glad of your and Mr. Todd's sentiments on it. My respects to that gentleman; and be assured that I am, very affectionately, dear Sir,

Your most humble servant,

B. FRANKLIN.

12 PHILADELPHIA, Nov. 8, 1753.

Dear Sir,

THE first intimation I find of the new air-pump, is in a piece of Mr. Watson's, read to the Royal Society, Feb. 20, 1752, where describing some experiments he made in vacuo, he says—"The more complete the vacuum, cæteris paribus, the more considerable were the effects; and here, I should not do justice to real merit, were I silent in regard to Mr. Sweaton. This gentleman, with a genius truly mechanical, which enables him to give to such philosophical instruments as he executes, a degree of perfection scarce to be found elsewhere; this gentleman, I say, has construc-

ted an air-pump, by which we are impowered to make Boyle's vacuum much more perfect than heretofore. By a well conducted experiment, which admits of no doubt as to its truth, I have seen by this pump the air rarified to 1000 times its natural state; whereas, commonly, we seldom arrive at 150. As the promotion of the mechanic arts is a considerable object of our excellent institution, if this gentleman could be prevailed upon to communicate to the Royal Society that particular construction of his air-pump, which enables it to execute so much more than those commonly in use, it would not fail to be an acceptable present." So far Mr. Watson. In April following, was read a letter from Mr. Sweaton, in which he describes his improvements, and gives a draft of his pump; the whole too long to transcribe; but it appears to me that the machine being rather simplified, than more complex, can scarce cost more than one of the old sort, though the price is not mentioned. By only turning a cock, it is at pleasure made a condensing engine. An advantage the others have not.

I have seen nothing of your searchers.

Mr. Parker has received Bower, but writes me that he is at a loss how to send it, and desires you would order somebody to call for it.

I shall send the dollars for Mr. Mix, per next post. For I fancy you will not now buy this apparatus here, but chuse the new air-pump from England.

My respects to all friends, concludes from, dear Sir,

Your obliged humble servant,

B. FRANKLIN.

13 PHILADELPHIA, Aug. 31, 1755.

Dear Friend,

I have been employed, almost all this summer, in the service of our unfortunate army, and other public affairs, that have brought me greatly in arrear with my correspondents. I have lost the pleasure of conversing with them, and I have lost my labour: I wish these were the only losses of the year: but we have lost a number of brave men, and all our credit with the indians; and I fear these losses may soon be productive of more, and greater.

I have had no opportunity of making the enquiry you desired, relating to Leonard. Somerset county, in Maryland, is 150 miles from hence, and out of the common road of travellers, or the post, nor have I any correspondent, or acquaintance there. But now, while I am writing, I recollect a friend I have at Newtown, within 50 miles of Somerset, who has a very general knowledge of those parts, and of the people, as he practices the law in all the counties on the eastern shore of Maryland: I will immediately write to him about it.

I am sorry your newspapers miscarry. If your riders are not more careful, I must order them to be changed.

The Mitchel who made the map, is our Dr. Mitchel. I send you one of Evan's new maps, which I imagine will be agreeable to you. Please accept it.

I am glad to hear your son has acquired the true art of making steel. I hope it will prove profitable.

Mr. Roberts is pleased that you so kindly accept his fork and rake. I suppose he will write to you; but he is a man of much business, and does not love writing: I shall learn once more (for he told me once, and I forgot it) how those teeth are put in, and send you word; but, perhaps, our friend Bartram can tell you. He delivers you this, and I need not recommend him to you, for you are already acquainted with his merit, though not with his face and person.-- You will have a great deal of pleasure in one another's conversation; I wish I could be within hearing; but that cannot be. He is upon one of his rambles in search of knowledge, and intends to view both your sea-coast and back country.

Remember me kindly to Mr. Tufts, and Mr. Ruggles, when you see them. My respects to your good lady and family

With the greatest esteem, I am, dear Sir,

Your most affectionate humble serv't.

B. FRANKLIN.

14 PHILADELPHIA, Sept. 1, 1755.

Dear Sir,

I wrote you yesterday, and now I write again. You will say, it cant rain, but it pours. For I not only send you

manuscript but *living* letters. The *first* may be short, but the *latter* will be longer and yet more agreeable. Mr. Bartram I believe you will find to be at least twenty folio pages, large paper, well filled, on the subjects of botany, fossils, husbandry, and the first creation. This Mr. Allison has as many or more, on agriculture, philosophy, your own catholic divinity, and various other points of learning, equally useful and engaging. Read them both. 'Twill take you at least a week; and then answer, by sending me two of the like kind, or by coming yourself. If you fail of this, I shall think I have overbalanced my epistolary account, and that you will be in my debt as a correspondent, for at least a twelve month to come.

I remember with pleasure the cheerful hours I enjoyed last winter in your company, and would with all my heart give any ten of the thick old folios that stand on the shelves before me, for a *little book* of the stories you then told with so much propriety and humour. Adieu, my dear friend, and believe me ever Yours affectionately,

B. FRANKLIN.

Dr. Elliot.

P. S.—The piece of iron ore you mentioned in yours of April 10, never came to hand. I forgot to mention, that the bearer, Mr. Allison, is Rector of our Academy, and my particular friend. He is on a journey northward for health.

INTELLIGENCE AND MISCELLANIES.

I. *Foreign.*

(From a Correspondent.)

Prices of some minerals in London.—On looking over a marked catalogue of a sale by auction, of minerals in London, I was induced to copy a few items, which I send for your valuable Journal, as in this country, we often hear, even good mineralogists, express great surprise at the price

demanded for small specimens in England, and as data for estimating the value of our own minerals.

Your's, F. L.

	£	s.	d.
A group of amethystine quartz, with pearl spar, Hungary,	0	4	6
A specimen of Haüy's petrosilex, from the river Argun, in Nertschinsky,	1	2	0
Carbonate of iron on quartz, Hartz, Topazine, Cubic Fluor, Gersdorff,		11	
Fascicular oxide of manganese, Hefeld, on the Harz,		7	6
Prismatic carb't. of lime, on Galenca, Cumberland,		6	6
Transparent quartz, with chlorite, Brazil,		10	
Amianthoide, on Adularia, St. Gothard.	1		
Rose coloured fluor, Chamouni, in Switzerland, and needle mesotype, Ferro,	1	10	
A single crystal of Arragonite, Molina.	1	8	
Chromate of lead, Beressoff,		12	6

From Thomson's Annals, for Nov. 1821.

"*Lithography.*—An experiment has lately been made to take off impressions from the leaves of plants, by lythographic printing. It appears to have been attempted by merely pressing the leaves against the stone. This process does not, however, appear the most adviseable; the better way being to cover the plant with the prepared ink, and after bringing a sheet of clean paper in contact with its entire surface, transfer the impression thus procured to the lithographic stone. We notice this from the great advantage which botanists are likely to derive from this simple mode of preserving and multiplying impressions from rare plants, which could otherwise, be seen only in the cabinets of a few collectors."

From Brandes' Journal.

"*On meteorolites, by M. Fleuriau de Bellevue.*—A paper by M. Fleuriau de Bellevue, was read to the Academy of Sciences last year, on meteoric stones, and particularly on those which fell near Jonzac, in the department of Cha-

vente." The following conclusions are presented as those drawn by M. Bellevue :

1. The appearances presented by the crust of meteorolites, seem to prove that their surface has been fused whilst rapidly traversing the flame of the meteor, and rapidly solidified into a vitreous state on leaving that flame.

2. They prove that in the first moments, the movement of the meteorolites was simple, that is, that they did not turn round on their own axis, whilst those two effects took place.

3. That the impulse each meteorolite has received has almost always been perpendicular to its largest face.

4. That the largest face is almost always, more or less, convex.

5. Our meteorolites (those of Jonzac) offer new proofs of the pre-existence of a solid nucleus, to bolides or meteors.

6. This nucleus could not contain the combustible matter which produced the inflammation of the meteor.

7. It cannot have suffered fusion during the appearance of the phenomena.

8. The gaseous matter, which surrounds this nucleus, is dissipated without producing any solid residuum. No trace of this matter appears ever to exist in the crust of the meteorolites.

9. Meteorolites are fragments of those nuclei which have not been altered in their natures, but simply vitrified at their surfaces.

10. Many of the irregular forms which these fragments present, may be referred to determinate geometric forms.

11. These latter forms are the consequences of the rapid action of a violent fire, according to a law of the movement of heat in solid bodies, discovered by M. Emen.

Jour. de Phys. XCII. *p.*159.

Foreign Literature and Science.

Communicated by Prof. Griscom.

1. *Human bones in a fossil state.*—Baron de Schlottheim, of Saxony, well known as the author of an *Antideluvian*

Flora, has just published a *catalogue raisonnè et methodique* of his collection of fossils, the most complete perhaps in existence. Among other objects, he describes the *Anthropolites*, or fossil bones belonging to the human species, which have been discovered in the environs of Kostriz, near Gera, in the county of Recuss, in Upper Saxony. The rock on which the whole secondary stratum rests, is a *transition argillaceous schist*, of a reddish grey colour. It covers a hard firm grained *grau-wacke*, which occasionally makes its appearance in the beds of the streams. Immediately above this schist is old secondary limestone, in nearly horizontal strata. Old secondary gypsum is in some places inserted in the limestone, and is subordinate to it. An alluvium, composing a dryer soil, and occasionally sandy, covers all these secondary rocks. This soil which richly rewards the industrious cultivator, occupies an extent of many square miles. The secondary limestone is in many places cavernous, the cavities often containing numerous stalactites. Large openings, or cavities are also filled with the superincumbent clay. It is in one of the largest cavities of the limestone, and at the depth of twenty feet, and in the residue of the clay which fills the cavity, that the bones of large animals have been found. Among these bones are various fragments of the *Rhinoceros antiquitatis*, the jaws and teeth of a species of antediluvian horse, principally distinguished by the extraordinary length of its teeth. Vertebrae and tibiae of cattle, and stags of very extraordinary size. The lower jaw, and teeth of a large antediluvian *hyena*, (canis crocutaformis major, of Cuvier) fragments of the *leo diluvianus*. All these bones are, more or less, changed, and penetrated with calcareous matter; but as bones are found at much greater depths in clay, in some other places, and much less changed in their substance, it is admitted that a greater or less alteration of the substance of those fossil bones, cannot in any wise, serve as an indication of the difference that may exist in their relative ages; nor that the species to which they have belonged, have perished at different epochs.

The gypsum, which is subordinate to this cavernous limestone, presents itself in large uniform masses, or short thick beds inserted in the limestone. In these beds of gypsum, cavities, and fissures also exist, which extend themselves in

all directions, but of less dimensions than the limestone caverns. They are filled however, with the clayey alluvion, which descends to the greatest depths.

It is in these clayey masses which fill the crevices of the gypsum, that are found, collected in heaps or nests, and in circumstances perfectly similar, a multitude of bones of terrestrial animals, among which are evidently some of the *human species.* These plaster quarries have been open thirty years, during which these groups of bones have been found always imbedded in the same manner. The human bones are mingled with those of other animals, in detached pieces, and without forming an entire skeleton. In considering all the circumstances of their situation, it is fairly to be presumed, *that these human bones are really fossil remains, and contemporaneous with the other bones with which they are mingled; and that they have been driven and deposited by the waters, which have formed the alluvial stratum which covers the secondary rocks of this country; and consequently then, man existed prior to the formation of the alluvial earth, which resulted from the last great revolution which has changed the surface of the globe, and during which a northern climate, before unknown, became established.*

Mr. Cuvier has justly observed in his *researches*, Tome I. page 66, that this last epoch of the great inundation, which destroyed a crowd of animal species, whose remains are found only in alluvion, and in no rock more ancient, accords well with our chronology. The instructive facts now before us, seem to add fresh confirmation to the tradition of this inundation, a tradition which is preserved among all nations.

The principal parts of the human frame that have been thus obtained, are a frontal bone, with the half of the ophthalmic orbits, the left part of a male pelvis, the tibia of the left leg, and the right and left femur.

Bibliothique Universelle, Nov. 1820.

2. *Climate of the South of France.*—Dr. James Clark has published (London, 1820,) "Medical notes on Climate," in which he appears to prove, that consumptive patients have no just reason to expect that benefit from the air of the northern shore of the Mediterranean, which so many are eager to seek for. The wind which blows from the mari-

time Alps, called the *mistral*, and which produces a sudden, and most unpleasant change of temperature, is of itself sufficient to discourage delicate, and phthisical patients from exposing themselves to its attacks. These winds in general, produce *hemoptisis* in those whose lungs are affected; even the physicians of Nice, who are strongly disposed to recommend that place to the sick, in the months of November, December, and January, acknowledge that the cold winds of the three following months are very unfavourable. But in the middle of winter it is very difficult for sick people to find the means of retreating from these warm, and comfortable quarters, without exposing themselves to the attacks of the *mistral*. Dr. Vodici, a very enlightened physician of Nice, said to Dr. Clark, "you may assure your colleagues, and countrymen that it is a miserable practice to send their consumptive patients to die at Nice. The English make this fatal trial every year, and the cemetery of *la Croix de marbre*, but too clearly attests the consequences. *Rev. Encyclopedique.*

3. *Pressure of the atmosphere.*—Père Biseln, Prior of the hospital of mount St. Bernard, states that the atmospheric pressure is so diminished that water boils at a temperature of 78. 8. Reaumur, which renders it necessary to cook their meat from five, to five and a half hours, which on account of the scarcity of wood, is a serious inconvenience. In consequence of this, it has been proposed to supply those good monks with Papin's digester, as a remedy for this difficulty.

4. *Zoology.—New species of Salamander.*—Dr. Paolo Savi, adjunct professor of Botany, in the University of Pisa, has found in various places, in the Appenines of Tuscany, and especially at Mugello, a new species of Salamander, very remarkable from its figure, and colours, and endowed with characters so particular, that it appears hitherto to have been undescribed. He calls it *Salamandra perspicillata quinque palmis plantisque tetradactylis.* It has a spot in the superior part of the head, which resembles very nearly, a pair of spectacles. But what is still more characteristic, is the fact, that it has four toes on each foot: so that it cannot be confounded with the Salamander of three toes men-

tioned by Mr. Lacepede. (Hist. Nat. Tom. VI. pa. 496.) The detailed description of this new Salamander is given in the *Bibliotica* Italiana, No. LXV. *Rev. Ency.*

5. *Meteorolite.*—There fell in the commune of Juvenas, France, on the 15th of June last, an Aerolite which weighed 220 pounds. The inhabitants of Juvenas, as well as those of the neighbouring country were so terrified with the frightful noise which accompanied its fall, that it was not until the 28th of the month that any one dared to venture upon an enquiry after the object which they had seen falling at some distance from their habitations. But when the stone was found, the inhabitants eager to turn it to some profit, broke it up into small pieces. It was known only that a portion of it examined by the hydrostatic balance gave a spec. grav. of 2.80 and that it had no action on the magnet. *Rev. Enc.*

6. *Remarkable Diamond.*—The East India Company have sent to England a Diamond which was taken from the Pacharva of the Mahrattas, which weighs 358 grains. Next to the regent diamond, and one belonging to the Emperor of Russia, it is the finest stone in Europe. *Rev. Enc.*

7. *Circulating Libraries.*—According to a published account there are in England about 600 reading companies or associations, (consisting of from 10 to 25 or more members) which procure for their own special use such publications as they may wish to peruse, and at certain periods those books which have been the round among the members, are at a general meeting of the company sold to the highest bidder. The funds are thus replenished, and knowledge and entertainment of the best kind agreeably, and cheaply provided.

8. *Traveller's Society.*--A social company has been formed in Liverpool under the name of the *traveller's society.* No person is eligible to membership who has not been 500 miles from home. At their meetings, it will readily be imagined there must be a variety of amusing and instructive anecdotes, and much information imparted that will naturally tend to enlighten and liberalize the mind.

9. *Russian Establishments.*—Count Romanzof (the same person that charged himself with the expense of the expedition of M. de Kotzebue) who is possessed of an immense estate in the government of Mechilof, with a view of providing for the education of the children of the peasantry, has erected a beautiful building for a school and dwellings for masters. It is destined to receive three or four hundred pupils, who will be instructed in reading, writing, calculation, geography and some knowledge of natural history. They may also acquire the elements of useful trades. The name of Romanzof is one that cannot be pronounced without mentioning some new act of beneficence. *Rev. Enc.*

10. *Lunar Volcanoes.*—Dr. Olbers observed on the 5th of last February, the phenomenon which some philosophers have attributed to volcanos in the moon. He declared that he never perceived it more distinctly. The spot called Aristarchus, threw out a very vivid light, and appearad like a star of the 6th magnitude, placed on the north-east of the moon. The evening of the 6th unhappily was not so fine as that of the preceding day, and Dr. O. could not pursue his observations, but the English journals announce that Capt. Kater had made on the 7th of Feb. a report to the Royal Society of London in which he affirms that he had seen a lunar Volcano in actual eruption. Dr. Olbers thinks that the observations of Capt. K. coincide exactly with his own, but he differs from him with respect to the cause. He does not admit the existence of a volcano in the moon; he thinks that the phenomenon which Capt. K. regards as such, is produced by the reflection of the light cast by the earth on the open immense rocks of a smooth surface, situated on the part of the moon called *Aristarchus*. Should these rocks, says Dr. O. send back only a tenth part of the light which they receive from the earth, (our mirrors return one half of the incident light) the effect would be equal to a star of the sixth magnitude. It is in this way that Dr. Olbers accounts for our always seeing those spots in the same place, and also why they do not show themselves at each lunation. On the 6th of March, Dr. Olbers could distinctly see all the spots of the moon; Grimaldi, Copernicus, Kepler, Manidius, &c. Aristarchus, was particularly remarkable, but it was not so splendid as on the 5th of February.

The hypothesis of volcanoes in the moon is not modern, and at present it is almost rejected, and the explanation of Dr. Olbers is generally admitted. The spot *Aristarchus*, is plainly to be seen when the moon is illuminated by the sun, and hence it is natural that it should appear more luminous than the rest of the disc, when it is enlightened only by the earth. As to the variation of extent which is remarked commonly in the spots at the beginning of a lunation, the phenomena of refraction, produced by the position of the moon near the horizon, are sufficient to explain it without having recourse to Lunar Volcanoes. *Rev. Enc.*

11. *Pavia.—Remedy against Hydrophobia.*—New experiments, prove the efficacy of chlorine in the treatment of Hydrophobia. Dr. Previsali has prescribed it with success, in several cases in which the symptoms of that frightful malady had already manifested themselves. He administers it in the form of a drink in the dose of a gros or a gros and a half per day, in citron water, or citron syrup. *Rev. Enc.*

12. *Padua.*—The enterprising traveller Belzoni having given to Padua his native place two colossal statues of Isis, of Egyptian porphyry, found in the ruins of Thebes, the grateful Paduans in placing them in the Sola dello Ragione had a large medal struck in honour of their fellow-citizen, representing on one side the two Egyptian statues, and on the other, bearing an inscription. *Idem.*

13. *Libraries of St. Petersburgh.*—1st. the *Imperial Library* at the hermitage, contains 300,000 volumes. Though already rich in beautiful and rare works, it continues to increase in them. Two Librarians are charged with the care of it. 2d. The Library of *Zaluski*, now *imperial.* It belonged to the republic of Poland, and was transported in 1799 to Petersburgh, where it has been carefully placed in an elegant building. At each stage there is a beautiful rotundo, and two lateral halls. It contains like that at the hermitage, 300,000 volumes, among which, are the most valued works of ancient and oriental philosophy. It is preserved with care, and open to the public. 3d. The *Library of the Grand Duke Constantine*, consisting of about 30,000 volumes of diplomacy, history, and the military art.

4th. That *of the Academy of Sciences:* next to the imperial Libraries, this is the most considerable, for it contains 60,000 volumes: among which are 3,000 in Chinese, Mantschou and Tongutschou. It is rich also in Asiatic manuscripts, in drawings of plants and butterflies, and in other objects of natural history, coming from Madame Mérian and Dr. Fothergill. The Russian works to the number of 3,000 are separate from the others. 5th. The *Library of the Convent of Newski* containing Sclavonic manuscripts, acts of councils, writings of the German philosoopher Wolf, and many theological treatises. 6th. *The Library of the corps of Imperial Cadets:* it has more than 12,000 volumes, and is annually increasing. 7th. *The Library of the College of Medicine.* 8th. *That of the Economical Society.* 9th. *That of the University*, lately founded and which has already 11,000 volumes.

St. Petersburgh contains besides more than twenty private libraries, worthy of being mentioned as well for their extent as for the rare and valuable works which they contain; such are those of Counts Ischernichef, Schouvalof, Ischeremetef, Strogonof, Youssoupof, Boutourlin, the late princess Datschkof, counsellor Betzkoi, of prince Kourakin, of Lieutenant General Klinger; the latter possesses the best collection of literary, historical, philosophical and political works in English, French, German and Italian. It contains a beautiful collection of autographic manuscripts of princes, officers, statesmen and learned men of the different countries of Europe. This collection known at first under the name of Doubrowski, is become imperial.

Rev. Enc.

14. *Aurora Borealis.—A Royal Author.*—The Ex-King of Sweden (Colonel Gustavson) has printed at Frankfort, a memoir entitled, "Reflections on the phenomena of the Aurora Borealis and its relation to the diurnal motion." It is written in French, and dedicated to the Royal Academy of Sciences of Norway. The Aurora Borealis has been ascribed to various causes,—by Mairan to the solar atmosphere,—by Lemonier to a matter which exhales from our globe, and arises to a prodigious height in the atmosphere, by Dr. Franklin and others to electricity—by Dalton and Arrago to an effect purely magnetic—this last opinion has been generally adopted. Colonel Gustavson endeavours

to prove that the Aurora Borealis has its origin in an inflammable matter produced by the friction of the globe in turning upon its axis, and by an electric fire, which collects round the pole. He figures to himself this region as a great mountain, rising in form of a cone at the foot of which are attached petrified flakes of ice which plough the icy sea. He supposes the terrestrial atmosphere to be vastly higher than is generally admitted, and that the polar mountain is a magnetic mass of an immense volume, the effect of which is to maintain the diurnal motion of the earth!!

Rev. Enc.

15. *Geneva.*—The *method of mutual instruction* continues to receive direct encouragement in our city. A very large building is now constructing, in which is to be placed a new public school, organized according to this method. Many of our protestant pastors of the country have established similar ones in their parishes, and direct them themselves with a zeal worthy of the greatest praise. Their example has been imitated by several rich proprietors, notwithstanding the opposition both open and disguised of certain curates. *Idem.*

16. *Naples--Surgery.*–Catanoso of Messina, a pupil of the medical school of Paris, has performed thirteen times in succession in this city, and with the happiest success, the operation for cataract by extraction.

17. *Deaths in France.*—*Gouan*, the oldest of the professors of the school of Montpellier, the friend of Linneus, of Haller, of Seguier, of Jussieu, and other celebrated botanists. He died at the age of 88.

Corvisart, one of the most distinguished physicians of Europe, died at Paris at the age of 67, on the 19th of September last. He was first physician to Napoleon. His obsequies were celebrated at Athens where he had an estate. Leroux Dean of the faculty of Medicine, pronounced on the occasion a discourse in which he expressed the regret of all those who knew this celebrated man, to whom the medical sciences were under so many obligations.

18. *Ellious Boethor*, professor of Arabic in the King's Library. He died of a disease of the liver after two weeks illness, on the 26th of September. He was born at Syout, in Upper Egypt, and was interpreter to the French army. He was scarcely 40 years of age. He had acquired by labour and study, great perfection in the language and literature of France. He expressed himself with facility and clearness in French and in Arabic, and though it was easy to recognise in his delivery a foreign pronunciation, it was not so with respect to the propriety of his terms and even the elegance of his diction.

The loss of this man is to be regretted not only on account of oriental literature, and public instruction: it is still more sad in reference to the civilization of Egypt. He formed a natural tie between France and his native country. Familiar with the grammarians, the literati, the philosophers, and all the principal writers of France, he would have been able, above every other person, to initiate pupils chosen among his own countrymen in our arts and sciences.

Ellious Boethor first became known at Paris, a few years since, by his decyphering and translating with the greatest facility, the numerous pieces in Arabic preserved in the war department. He brought with him a large dictionary in the two languages, the fruit of ten years labour and meditation in which each of the acceptations of the Arabic words is justified by examples taken from good authors. This manuscript is in the hands of his widow, and constitutes her whole dependence. We doubt not that the government will obtain it and print it for the benefit of students, and especially of the pupils in the oriental schools of Paris and Marseilles. We believe the author had also composed an Arabic and French Grammar. He has left a blank very difficult to fill, for it requires conditions which it is almost impossible to conciliate.

Jomard. Rev. Ency.

19. *Botany.*—They are now cultivating in Sweden the *astragalus balticus* (Linneus) as an excellent substitute for coffee, and the decoction of which requires only the fifth part of the sugar commonly used. This plant produces six hundred or a thousand fold, and does not suffer from intense frost. Dr. Bayrhammor of Wurtzburg, offers to

send gratuitously one hundred grains to any one who will promise to cultivate it, and make known the result.

20. *Style of the Orientals.*—A diploma of the Persian order of the *Lion-of-the-Sun*, which has recently been sent to Joseph de Hammer, of Vienna, presents in the following address, literally translated, a curious example of the oriental style. It thus announces the titles that have been given him on this occasion:—"Very estimable, very honourable, eloquent in the art of oratory penetrating, skilful interpreter of the language of the good christian people, who believe in Jesus, Counsellor of the high imperial German Court, whose pen is well made, whose writing is flowery, whose fingers are nimble, whose tongue is well practised, column of the most excellent and the most venerated, lily of ten languages, Joseph Hammer, &c."

21. *The Inauguration of a Colossal Statue of Luther*, was to take place in the city of Wittemberg, by order of the Prussian Governments, and with great solemnity, on the 31st of October, the anniversary of the day on which Luther separated from the Catholics, by posting upon the University of Wittemberg, in 1517, his famous Theses against the Court of Rome. The king, and all the protestant princes of Germany were to assist at this ceremony, which is a national festival to the whole of evangelical Germany.

Rev. Ency.

22. *Amsterdam Canal.*—The Dutch are actively engaged in constructing a grand Canal in North-Holland. It will be twelve miles in length, and twenty-five feet deep, so as to be navigable for East-India ships from the Helder and the large port of Het Nieuw Diep, to the Het Y. before Amsterdam. This undertaking does great honour to the inspector general Blanken: it is no inconsiderable enterprise to construct a canal of this extent in a marshy soil, consisting in a great measure of a kind of floating turf under a bed of clay, and of attaching to it massive sluices, each of which must cost 300,000 florins. A great number of boats must be employed in carrying away the turf and mud taken from the canal, for it will not do to throw upon

the borders of the canal such a mass of soft materials, as it would soon sink back again by its own weight. The labour will cost many millions ; the commerce of Amsterdam, to which this canal must be of the greatest importance, will contribute a million of florins of Holland. A part of it is finished, as well as the first great sluice at the entrance of the canal, opposite to Amsterdam.

23. *Cutlery.—Damascus Steel.*—One of our most skilful and industrious cutlers, Sir Henry de Besançon, having acquired the art of fabricating the steel, called *Damascus*, very superior to that of Persia and Syria, now employs it in making instruments of surgery, which are far more valuable than those of English cast steel. The extreme hardness, and great elasticity of the Damascus, render it particularly important in the fabrication of instruments that require a very fine edge, such as razors, bistouries, lancets, instruments for cataract, &c. which so soon lose their edge, especially when used to pierce or cut very strongly resisting bodies. We have seen the lancets of Sir Henry pass through with the greatest facility pieces of parchment and thin plates of lead, without any injury to the edge, whilst very good common lancets, treated in the same manner, were either broken, or so much dulled as to be unfit for use. Sir Henry fabricates with his Damascus all other kinds of cutlery, as knives, scissars, &c. with which bones, ivory, and even iron may be cut, without being dulled. The "Society of Encouragement," the New Journal of Medicine, and many other Gazettes, have spoken with much eulogium of these new and useful products of French industry. Sir Henry has his in the place de l'ecole de Medicine," at Paris. *Rev. Ency.*

24. *Instruction in Latin by the method of J. J. Ordinaire.*—In stating that several institutions in Paris have adopted the method of instruction devised by J. J. Ordinaire, Rector of the Academy of Besançon, we engaged to make known their labours and success. We attended the exercises which took place on Tuesday the 19th of July, in the beautiful establishment of M. Morin, the only one which M. Ordinaire superintends himself. The following are the results which appeared at that time. The class of M. Mo-

rin was opened in the beginning of June. In the course of the first week, four divisions, composed of seven or eight boys, were successively formed and exercised upon the new system. The first division, that is to say, the most advanced pupils, had been engaged only six weeks, from which must be deducted Sundays and holidays, which reduces the time to thirty-five days, during which they were engaged in study. In this short space of time the pupils of the first division, who before knew not a word of Latin, had learned, 1st. the twenty-six tables of Latin declinations, regular and irregular, so as to repeat, without the least confusion, any of the cases, separately or collectively, and in any order which might be pointed out. 2d. The signification of a thousand Latin substantives, namely, all those which are found in the text of *Epitome historiæ sacræ*. They give not only the French which agrees with these words, but also the Latin when the French is named to them, and likewise the proper inflections of three thousand Latin radicals in either of the numbers named to them. 3d. These children knew in the same manner more than 200 Latin adjectives, to which they could give the substantive termination and declension, when the adjective was derived from a substantive, or the *adverbial* termination, when they were susceptible of it.

The pupils of the other divisions followed very closely those of the one we have just spoken of. All replied with facility to the questions put to them upon the radicals and declensions, upon the formations of cases, genders and numbers; on the value of the Latin accent, the orthography of the two languages, &c.

We remarked also among these pupils that emulation and satisfaction which the old method regards as incompatible with the study of the dead languages. The ardor of these children is such, that they are obliged to moderate it, and there is no question that after four months' application they will be able to explain the *Epitome historiæ sacræ*—a result to which M. Ordinaire himself had allotted at least eight months.

There is no father of a family, no member of the university, who attended these exercises, that did not unite his thanks to those of the "*Society for Elementary Instruction*," at its last session, to the respectable Rector of Besançon.

Rev. Ency. for July, 1821.

This new method of teaching Latin, depending in some measure on a new tabular arrangement, or classification of words which the pupils are to commit to memory, has excited considerable attention in France. It is thus noticed in the Revue Encyclopedique for September last:

"We have shewn (page 230) the point to which the pupils of M. Morin, instructed by this method, under the direction of M. Ordinaire, had attained on the 19th of July last, after thirty-five days of study. From that time to the 24th of September, in spite of the derangements caused by vacation, the more advanced pupils have learned more than 1,800 words, viz. the rest of the adjectives in the *epitome historiæ sacræ* with their adverbial inflections. 2d. The table of the names of Latin numbers, ordinary and cardinal, as well as the adjectives and adverbs derived from them. This table is so familiar to the children that they translate immediately, and without hesitation, the most complicated numbers expressed either in Latin or in French,—a thing which no pupil of Rhetoric, and even very few professors, would be able to accomplish. 3d. All the pronouns. 4th. The prepositions, with their complements. 5th. The verbs, regular, irregular, and deponent of the first and second conjugations. These 1,300 words, added to the 1,200, which the pupils knew in July, form a total of 2,500 Latin radicals, to which they apply all the inflexions of each of them. Furthermore, they translate immediately, with the greatest facility, Latin phrases formed of those words, the explanation of which requires no knowledge of the rules of Syntax; and they analyze them also with perfect regularity. But what is still more remarkable, they turn French phrases into Latin, without any other assistance than their memory and their judgment, which are equally developed by these exercises.

Such are the results which M. Ordinaire has obtained in three months and a half, with pupils frequently interrupted in their studies; results which any one may verify for himself, as we have done, with the deepest interest.

The increasing success of this Latin class has determined M. Morin to annex to his establishment a contiguous building, which will give him the means of receiving seventy additional boarders. Experience has proved that the more considerable the number of pupils, the more rapid is their progress, because then it is more easy to class the children

according to their attainments. A professor has been sent from Brussels to acquire this method of instruction, in order to introduce it into the capital of Belgium. Let us hope that the university of France will not allow foreigners to take the lead in this system, but that it will promptly introduce it into the inferior classes of the Royal Colleges. This hope is the better founded, as the members of the corps of instruction, who have studied the work, or attended the school of the Rector of Besançon, found nothing to object to the method, and accorded with all those who have reflected on the subject, as regarding this system as infinitely superior to the existing method, the great defects of which occasion so much daily trouble to parents and the friends of youth.

25. *Physiology.*—Dr. Magendie, of Paris, has commenced the publication of a Quarterly Journal, entitled "Journal de Physiologie experimentale." The first three numbers have reached us, in which we find several interesting memoirs from the pen of that ingenious and indefatigable physiologist. In a short memoir on the structure of the Lungs in men, contained in the first number, the following facts are stated: 1st. That the greater part of the organic tissues contain so great a number of blood vessels, that they appear to be entirely formed of them. We may consider this fact as the actual limit of the anatomy of structure. 2d. That the best mode of studying the structure of the pulmonary organ is to inflate it partially by the orifice of one of the bronchial tubes, place a ligature so as to prevent the escape of the air, and then to let it dry in the open air, or before a fire. It is then transparent, and may easily be cut by a sharp instrument into thin slices. 3d. If one of them be held between the eye and a light, the pulmonary cells may be easily distinguished. These cells assume no regular form, appear to have no membranous parietes, but to consist entirely of the ultimate divisions of the pulmonary artery, the radicules of the pulmonary veins and of the multiplied anastomoses of all these vessels. 4th. That the cells of the lungs increase in size and diminish in number, as life advances. 5th. The specific gravity of the lungs is accordingly so diminished by age, that the lungs of an old man weighed fourteen times less than an equal vol-

ume of the lungs of a child. 6th. This increase of the cells is so regular, that in general the age of the individual may be assigned very nearly by inspection of the lungs. Disease, however, modifies the dimensions of the cells. Those who have coughed much before death, have them generally larger. 7th. If in individuals of advanced age, we find one side of the lungs diseased, the healthy lobe, inflated and dried, resembles a light foam. 8th. Old people accordingly consume less oxygen, have less animal heat, and are less able to resist cold than the young. 9th. The first indications of Phthisis of the most common or tuberculous kind consists in the deposition a greyish yellow matter in one or more of the cells of the lungs. This matter is sometimes moveable, and may probably be expelled, but it frequently increases, adheres to the small vessels, gradually obliterates them, and the whole lobe becomes tuberculous, or formed of this greyish yellow matter. 10th. Numerous as have been the bodies of Phthisical patients, which Dr. Magendie has opened, he has never seen in the cells, those little pearly grains, which, according to certain authors, are the first germs of Phthisis, but on the contrary, the matter which first forms is that which has been named tuberculous, and this matter has the appearance of being a secretion by the parieties of the small pulmonary blood vessels. 11th. Admitting this to be true, the commencement of Phthisis is only an alteration in the habitual secretion of the vascular tissue of the lungs, and this is one of the reasons which induced the author to employ sedatives, and particularly the hydro-cyanic-acid in the treatment of the two first stages of Phthisis. He has ever since had occasion to congratulate himself on this practice.

26. *New method of taking a fac-simile*, by *Cadet de Gassicourt*.—Paste a piece of white paper on the inside bottom of a porcelain plate;—write upon this paper with common ink, and before it is dry, sprinkle upon it very fine powder of gum-arabic, which will form a slight relief. When the ink is dry, brush off very lightly the superfluous powder, and pour into the plate a melted compound of eight parts of Bismuth, seven of lead, and three of tin, which is fusible at the boiling temperature. Cool it rapidly to prevent crystalization. A counter impression of the writing is thus ob-

tained, and by dissolving off the gum in tepid water, the plate presents characters, which, viewed by a lens, are very legible and beautiful. From this plate, by means of common printing ink, true fac-similies of the original writing may be produced.

Writing already dry, may be copied in the same way by going over the letters with a pen dipped in a very weak solution of gum, and then sprinkling it with powder, and proceeding as before, the only requisite precaution in this metallo-graphic operation, is, that the metallic plate must be of an even thickness, and that the surface on which the characters are traced must be smooth.

An. l'industrie national.

27. *Mineral Waters.*—A memoir of Professor J. Anglada of Montpelier, relative to the disengagement of azotic gas from sulphurous mineral waters, published in the Annals de Chimie of October last, exhibits the following results:—

1st. Those mineral waters, which, by the uniformity of their volumes, at all seasons of the year, seem to depend least upon the variations of the atmosphere, imbibe nevertheless a portion of atmospheric air, which is probably renewed by currents, the origin of which is unknown.

2d. The oxigen of the air, which accompanies sulphurous waters, combines with their sulphurous principles, while the azote escapes in a state of purity.

This disengagement of azote, and the presence of a glairous matter, analogous to animal substance, are good indications of degenerated sulphurous waters.

4th. This reaction of the air upon the sulphurous principle of mineral waters, is effected at all temperatures.

5th. If the characteristic phenomenon of this reaction (the disengagement of azote) cannot be asserted with respect to all sulphurous waters, (which requires more exact observations upon all the varieties of water) it is at least acknowledged that it holds good in all sulphurous waters, that contain an alkaline hydro-sulphate, (sulphuret?)

6th. The determination of this cause, destructive of the characteristic principle of sulphurous waters will often lead to the adoption of means proper to render this decomposition less active, and consequently to give a certain fixity to the dominant virtues of these waters.

7th. The influence of atmospheric air, which thus manifests itself, by the disengagement of azote, and the destruction of the sulphurous compound, is reproduced upon acidulous waters with the disengagement of azote, and according to all appearances, with the formation of carbonic acid.

28. *Incombustible cloth.*—Gay Lussac has ascertained that the hydrocholate (muriate) sulphate, phosphate, and borate of ammonia, borax, and some mixtures of these salts, are the most proper substances for rendering linen, or cotton cloth incombustible without changing their qualities.

29. *Cobalt.*—Dobereiner has contrived the following method to separate cobalt from nickel, and other metals from their oxids.

The oxide of cobalt or of nickel is mixed with oxalic acid, and exposed in a retort to the heat of a spirit lamp. When no more vapours are disengaged, or when the metal has acquired an ash-grey colour, the heat is withdrawn, and there is found in the bottom of the retort a pulverulent precipitate, which is the pure metal. This precipitate is introduced into a glass tube, and when subjected to a slight fusion, a button of pure metal is speedily formed.

Bul. de la Soc. D'Encouragement.

30. *Pyrolignous acid.*—There can be little doubt that the ordinary practice of curing meat by smoking, depends upon the action of pyrolignous acid, disengaged by the slow, and imperfect combustion of the fuel. It has accordingly been found that meat may be preserved, after it has been salted, by dipping it into an aqueous infusion of the soot of wood. A pound of soot is sufficient to cure three pounds of beef. The soot is put into a vessel with four pints of water, and allowed to macerate during 24 hours, with frequent stirring. It is then decanted, and it is found to be charged with about $\frac{1}{25}$ of its weight of the acid, and bituminous principles of the soot. In this solution the meat remains half an hour. It is then taken out and dried in the open air, and may be preserved at pleasure.

Bul. D'Encour. August 1821.

31. *Signals for a great distance.*—Schumacher, a captain of artillery, has invented a Rocket which may become of great use to astronomers, and geographers. They have a much greater force than the Congreve rockets, and ascend to a prodigious heighth. When at their greatest elevation they explode, and produce in the air a volume of light, so strong, and clear as to be distinctly perceived at a distance of 30 leagues. The inventor placed himself in the little Island of Hiveen, in the Cattegat, and launched his rockets; while his brother posted himself at the observatory of Copenhagen, to notice the effect. Though the distance is nearly 30 leagues, he saw, by means of a telescope, the explosions appear and disappear, resembling stars of the first magnitude. It is impossible to imagine signals more beautiful, or more expeditious for great distances. *Idem.*

32. *Merino sheep, and wool.*—A number of Merino sheep, and a quantity of wool, were sold at the Rural, and Royal establishment of Rambouillet, near Paris, on the 8th and 9th of June last.

The wool sold for 4 francs $\frac{57}{100}$, the kilogramme in the dirt. Lamb's wool, for 3frs. $\frac{82}{100}$, the kilogramme, (2lb. 3oz. 5dr. English)

Seventy rams, and sixty-four other sheep were sold, covered with wool. The highest priced ram brought $3117\frac{1}{2}$ francs, and the lowest price $376\frac{1}{4}$frs.

The maximum price for the other sheep, 258 francs, and minimum price, $134\frac{38}{100}$ francs. *Au. de Chinuc.*

33. *Enamel for porcelain.*—The societyat the Adelphi for the encouragement of the arts, have acknowledged the superiority of an enamel, or glazing, for fine porcelain, composed by John Rose. It consists of a mixture of 27 parts of feldspar, 18 of borax, 4 of sand, 1 of common salt, 1 of nitre, and 1 of argil. After it is melted into a frit, three parts of borax are to be added, and it is then reduced to powder.—This enamel attaches itself easily, and uniformly, without melting or even softening of the porcelain. It diffuses itself uniformly, without lumps or unevenness, and it does not conceal, or change the most delicate colours, such as greens and chromic red.

34. *Magnetism.*—Professor Hansteen, of Christiana, has announced the discovery, that all vertical objects, such as a tree, a wall, a steeple, &c. naturally becomes magnetic; the inferior parts acquiring a north, and the superior a south polarity. We shall wait impatiently for the particulars of these experiments. This subject has acquired a most lively interest in the estimation of philosophers, since Mr. Oersted has shown the relation between the magnetic, and electric fluids.
Rev. Ency.

35. *Orangeries.*—The inhabitants of the maritime Alps derive important profits from the cultivation of the orange. The town of Menton is the most famous for this fruit. It is gathered during the whole year. A good orange tree yields annually 2000 oranges, large and small, and occasionally the produce amounts to double that quantity. Those destined for commerce are gathered in winter, just as they begin to ripen, and become matured during the voyage.—Every orange must be wrapped in a separate paper envelope. The gathering, and packing occupies many hundred people. Considerable profit is also derived from the orange flowers. A singular fact is, that the orange tree communicates a bitter taste to the herbs that are cultivated around it. The citron has not this disadvantage.
Rev. Ency.

36. *Agriculture.*—Count Lasteyrie, of Paris, who has distinguished himself by his generous efforts in introducing, and perfecting the process of lithographic printing in that metropolis, has just completed the second, and last volume of a pictorial representation, and a verbal description of the machines, instruments, utensils, constructions, apparatus, &c. employed in rural, and domestic economy, according to designs made in different parts of Europe. The work is in quarto, and contains more than 1200 machines. The plates are executed without great attention to elegance, but with requisite precision, and exactness.

37. *Measurement of the meridian.*—Operations relative to a new measurement of the meridian, were commenced during the last summer, in the Russian provinces of the Baltic. Struve, professor of astronomy, and rector of the

university of Dorpat, presented the plan of this enterprise, which began upon the meridian of the observatory of Dorpat, Lat. 56 N. It will be executed at the expense of the university. The emperor has approved the plan, and has given two thousand ducats to procure the requisite instruments. Dr. Walbeck, astronomer at the observatory of Abo, acts in concert with professor Struve.

38. *Gymnastics.*—The Gymnastic establishment of M. Clias, in Switzerland, which has existed seven years, has obtained complete success. There now exist in the different cantons, fifteen gymnastic schools, well organized, annexed to academies, or colleges, and directed by pupils of M. Clias. A great number of boarding schools have also adopted gymnastic exercises, because they begin to feel generally, the advantages of this part of education.

39. *Marseilles.—Mutual Instruction.*—An evening school has just been opened in this town, for the admission of a great number of adult workmen. The minister of the interior, with a view to encourage this philanthropic object, has granted assistance to the founders of this school. In many establishments, the evening hours of the society are devoted to the elementary instruction of adults. The friends of humanity will doubtless wish, that these examples may find imitations in all parts of the kingdom.

40. *Zeal for antiquity.*—The circular zodiac of the temple of Denderah, in Upper Egypt, one of the most celebrated, and ancient pieces of antiquity, in relation to astronomy which the world can produce, has, with astonishing address, and dexterity, been removed from the elevated platform of the temple, conveyed to the Nile, floated down the rivers to Alexandria, and transported to Marseilles, whence it will be taken to Paris, to ornament probably, the grand museum of the Louvre. It is a stone of about 10 feet square, attached to a mass of rock $2\frac{1}{2}$ feet thick.

41. *Hospitals in France.*—It appears by a recent work of Baron Dupin, entitled " Histoire de l'administration des secours publiques," that the number of individuals in the hospitals, and alms-houses of France, is now about 90,000,

viz, 30,000 sick—35,000 aged and infirm—and 25,000 children. In this number is not comprised, the aged who are supported at home, and the children at nurse in the country. The expense of this vast charity is estimated at 90 centimes, ($\frac{9}{10}$ of a pound) per day, for the sick; and 60 centimes for the aged, and for children: hence the total is from 24 to 25 millions (from 4 to 5 millions of dollars.)—The revenue of these establishments exceeds this expenditure, and is daily increasing by numerous legacies. Before the revolution, the number of foundlings supported by the public was about 45,000. It is now 60,000, and the expense of their maintenance is seven millions. Before the public bounty was extended to this numerous class of innocent sufferers, children abandoned by their parents, were publicly sold, under the portals of the church of St. Landry, to women with full breasts, to boatmen, to beggars, and it is said, to magicians. The current price was 20 sous.

42. *Animal Magnetism.*—It appears from the French Journals, that this singular and incomprehensible doctrine has been revived in Paris; and if a statement of certain effects produced by magnetism, at the hotel Dieu, during the months of October, November, and December, 1820, in presence of seven or eight Physicians, and several other persons whose names are given, are worthy of reliance, it must be acknowledged that the commissioners appointed by Louis XVI, with Dr. Franklin in their number, were clearly mistaken; and that Mesmer ought to be regarded as a man of real genius, misunderstood, and persecuted by his cotemporaries.

A detail of several cases has been signed by thirty physicians, and acknowledged by M. Husson, the hospital physician. One of these cases was,that of a young girl affected with histeria, and spasmodic vomiting, which nothing could check. She was quite given up, and her end regarded as near. As soon as she was magnetised, the vomiting ceased, and after a few trials she fell into a somnabulism; and experiments the most varied, ingenious, and exact, convinced the doctor that the magnetic influence was real, curative, and entirely independent of the imagination.

In other cases the magnetic sleep became so profound, that neither calling aloud in the patient's ear, shaking, pinching, nor even a caustic applied to the upper part of the thigh, and to the epigastrium was able to produce the least sign of sensibility either by cries, motions, or variations of the pulse. *Rev. Ency. Dec.* 1821.

43. *Bavaria.—Mineralogy.*—Baron de Schutz, known by the distinguished manner with which, during fifty years he has directed the administration of mines in that country, has just given to the school of *Landshut* his fine collection of minerals, consisting of 2,318 rare and valuable specimens, among which are a great number of fossils. This estimable philosopher, animated by the love of public good, has joined to this rich present, that of a part of his Library. *Idem.*

44. *Vesuvius.*—After the last eruption of Vesuvius, in the plain which surrounds its volcanic cone, were formed six other cones more or less profound. One of them rises nearly sixty feet, and has a perimeter of about 200 feet. A torrent of very fluid and ardent lava crosses it within. It was into the crater of this cone that a young French Officer, Louis Coutrel, precipitated himself on the 11th Jan. 1821, to put an end to a life embittered by "*ennui.*" Details of this circumstance were read to the Academy of Naples, by the Secretary M. Monticelli. *Idem.*

45. *Necrology.*—M. *Rodrigues* a distinguished astronomer, who was appointed by the Spanish government to unite with Biot and Arago in measuring an arc of the meridian, died suddenly at Madrid, aged about 45. His engagement had induced him to remain a long time at Paris and London.

46. *A New Mineral*, discovered in a depot of friable ligtrite at Kolowerux, near Berlin in Bohemia, has been named *Humboldtine*, by M. Riviero, who has written a memoir upon it, approved by Vanquelin, and the Academy. It is a *sub-oxalate of the peroxide of iron.*

47. *Society of christian morals.*—This society, quite new in France, held its first general sitting on the 20th of December last, in the room of the society for the encouragement of national industry. The Duke de la Rochefoucault Liancourt; peer of France, presided and pronounced a discourse in which he explored with a mild and persuasive eloquence, the objects and plan of the society. A report was afterwards read by M. Wilm, one of the Secretaries relative to the origin and progress of the association. Its formation has been much encouraged by the example of the *Peace Societies* of England, but the society of christian morals is founded on a more extended plan. No moral scheme, no philanthropic institution will be foreign from its objects. We doubt not that almost all persons in France and even in Europe, who connect in their own minds, sound political opinions with a proper idea of the influence of moral and christian virtue, will be anxious to unite with the new society.

The meeting was composed of distinguished characters. We remarked among them persons of the three christian communions which exist in France, members of both chambers, ecclesiastics, members of the Institute, &c. &c.

The regular meetings, which every subscriber will have the right to attend, will be held the first Monday of every month at 7 in the evening. It is expected that the first number of the journal which the society intend to publish will appear before the end of January, 1822. Letters and subscriptions are received by Treuttel and Wurtz, Rue de Bourbon, p. 17, and by the same house, No. 30, Soho Square, London.

II. DOMESTIC.

1. *Two singular cases of the effects of the nitrous oxid, or exhilarating gas.*

For several years the medical class, and the two senior academical classes in Yale College, while attending the chemical lectures, have been in the habit (each class by itself) of preparing for themselves, and administering to their

respective members, the nitrous oxide, or exhilarating gas.

The relations of the effects of this gas have been so frequent, and similar, that they have become trite ; there were, however, two cases during the last season, which appear worthy of being published.

Case 1.

A. B. a member of the junior class, about 19 years old, is a person of a sanguine temperament, of a cheerful turn of mind, and possessed of the most perfect health. He breathed the gas which was prepared, and administered in the usual dose, and manner. Immediately, his feelings were uncommonly elevated, so that (as he expressed it) he found it "impossible to refrain from dancing and shouting." Indeed, to such a degree was he excited, that he was thrown into a frightful delirium, and his exertions became so violent, that after a while he sunk to the earth, exhausted, and there remained, until having, by quiet, in some degree recovered his strength, he again arose, only to renew the most convulsive muscular efforts, and the most piercing screams and cries, within a few moments, overpowered by the intensity of the paroxysm, he again fell to the ground, apparently senseless, and panting vehemently. The long continuance, and violence of the affection, alarmed his companions, and they ran for professional assistance. They were however, encouraged by the person to whom they applied, to hope that he would come out of his trance without injury, but for the space of two hours these symptoms continued; he was perfectly unconscious of what he was *doing*, and was in every respect, like a maniac; he states however, that *his feelings* vibrated between perfect happiness, and the most consummate misery. In the course of the afternoon, and after the first violent effects had subsided, he was compelled to lie down two or three times, from excessive fatigue, although he was immediately aroused upon any one's entering the room. The effects remained in a degree, for three or four days, accompanied by a hoarseness, which he attributed to the exertion made while under the immediate influence of the gas.

This case should produce a degree of caution, especially in persons of a sanguine temperament, whom, much more

frequently than others, we have seen painfully, and even alarmingly affected.

Case 2.

C. D. a member of the senior class, is a man of mature age, and of a grave and respectable character. For nearly two years previous to his taking the gas, his health had been very delicate, and his mind frequently gloomy and depressed. This was peculiary the case for a few days immediately preceding that time; and his general state of health was such, that he was obliged, almost entirely, to discontinue his studies ; and was about to have recourse to medical assistance. In this state of bodily and mental debility, he inspired about three quarts of the nitrous oxid.—The consequences were, an astonishing invigoration of his whole system, and the most exquisite perception of delight. These were manifested by an uncommon disposition for pleasantry and mirth, and by extraordinary muscular power. The effect of the gas was felt without diminution for at least thirty hours, and in a greater, or less degree, for more than a week.

But the most remarkable effect was that *upon the organs of taste.* Antecedently to taking the gas, he exhibited no peculiar choice in the articles of food, but immediately subsequent to that event, he *manifested a taste for such things only as were sweet*, and for several days *ate nothing but sweet cake.* Indeed, this singular taste was carried to such excess, that he *used sugar and molasses not only upon his bread and butter and lighter food, but upon his meat and vegetables.*—This he continues to do even at the present time, and although nearly eight weeks have elapsed since he inspired the gas, he is still found *pouring molasses over beef, pork, poultry, potatoes, cabbage, or whatever animal or vegetable food is placed before him.*

His health and spirits, since that time, have been uniformly good, and he attributes the restoration of his strength, and mental energy to the influence of the nitrous oxid. He is entirely regular in his mind, and now experiences no uncommon exhilaration, but is habitually cheerful, while before, he was as habitually grave, and even, to a degree, gloomy.

2. *Extracts of a letter from Wm. M'Clure, Esq. to the editor, dated, Madrid, Dec.* 4, 1821.

Progress of American Science.

"I am glad to hear of the rapid progress science in general, (and mineralogy and geology, in particular) makes in the United States. The men of science in Europe, are astonished at the rapidity with which one discovery succeeds another, and cannot conceive, how, in so short a time, so many hands, and heads are occupied with the exact sciences, and mechanics.

"The vast advantages attached to freedom, are unknown on this side of the Atlantic, and the spirit of energy with which a free people pursue whatever they perceive to be for their interest, are only beginning to be understood by the few.

(From the same, to the same.)

Comparative features of American and European Geology.

"The most striking, and strongly marked difference between the geology of North America, and Europe, is the regularity, continuity, and uninterrupted state of the stratification, for almost the whole length of the continent; and the absence of all rocks of disputed origin.

The trappose hornblendish rock which partially, and in patches, and ridges, covers the old red sandstone from the Connecticut river to the Rappahannock; and where the sandstone has been washed away in the states of New-York, Maryland, and Virginia, loose masses of the trappose rock cover the surface, as evidence of the continuity of the sandstone formation—this hornblendish rock is the nearest to a volcanic formation, of any I have ever seen in the United States, both from structure and relative position; it is found covering puddingstone, and sandstone aggregates, of rounded particles, made so, most probably, by water; while we have not caught nature forming any rocks by water, at all similar to the Hornblendish rock; but we find many volcanic rocks almost similar in structure, and exactly corresponding in relative situation. This gives probability to the supposition, that it is of volcanic origin, and throws

many difficulties, and doubts on the supposition of Neptunian origin, for after the waves on the sea-coast, or the action of running waters had formed the sand, and rolled pebbles; to make the waters return in sufficient quantities to form a rock partly crystalline (which by the Wernerian system would require a great depth) is a forced supposition, that does not appear natural: but such is the forced theory of that system respecting Basalt, and all the newest floets-trap formation, which Werner supposes to be of aqueous origin, while their resemblance, both in structure and relative position, renders the supposition of their volcanic origin, much more simple and natural.

The geology of the United States, where every primitive transition, and secondary rock is found (except the basalt, and the newest floets-trap formation) that is found in Europe; at the same time, that no volcanoes are in action, is a strong argument against the Wernerian system—all these theories have had their day, and are fast going out of fashion."

3. *Delaware Chemical and Geological Society.*

An Association by this name was organized at Delhi in the month of August, 1821. It is composed of between forty and fifty well informed and respectable inhabitants of the County of Delaware, State of New-York. The object of the association is improvement in literature and science, but more particularly in chemistry, geology, and mineralogy—they proceed with spirit and effect; have collected a cabinet of minerals, and intend to procure a library and chemical laboratory—at each quarterly meeting an original scientific discourse is delivered, essays read, &c.

From the zeal, industry, and talents of the members of the Delaware Society, it promises to be a very useful institution—and we are happy in the opportunity of mentioning it to our readers.

4. *Interesting Example of Electrical Attraction.*

We have had occasion recently to observe the process of applying gold leaf in gilding the frames of looking-glasses and pictures. It is probably known to many persons, that the frame, after being duly prepared by a composition

which is laid upon it with a brush, is moistened with gin, or some other spirit. The gold leaf, cut up by a round-edged knife into pieces of suitable size, is taken up on a flat hair-brush, and brought with the gold downward very near to the place to which it is to be applied. When it comes within a short distance, generally about half or three-quarters of an inch, without any farther attention from the artist, it suddenly flies from the hair-brush to the surface on which it is to be laid, and clings to it, and embraces it with such delicacy, as to cover every roughness. The gold, apparently, makes just such an effort, as it does when attracted in the gold leaf Electrometer, and it appears to arise from the same cause, viz. an electrical attraction. This attraction is obviously produced by the evaporation of the spirits.

Evaporation is well known to produce electrical excitement, and to generate opposite states of electricity in the contiguous bodies. We should therefore expect the attraction to be strongest in the case of those bodies which evaporate most readily—accordingly the gold leaf is less powerfully attracted when water is substituted for spirit.

The success of the gilder appears, in these cases to depend very much on the exertion of a principle which he is very little aware of. It would seem, that but for this, it would be scarcely possible to apply the leaf with entire precision, to all the varieties of surface produced by the carver. We have thought it worth mentioning, as a happy illustration of a scientific principle, occurring in the practice of the arts.

5. *A Fermenting Pond.*

Extract of a letter to the Editor from Mr. Thomas H. Webb, dated Providence, Oct. 1, 1821.

I lately visited a pond in Sharon, (Mass.) known by the name of Mash-Pog pond, from which great quantities of lenticular argillaceous oxid of iron, and what is called cake ore, are procured. The pond from about the middle of August to some time in September, presents the singular appearance of working or fermenting, as beer does when new. Whether this appearance is peculiar to *this* pond, I do not know.

Remark.—It would be well to catch some of the gases, which, without doubt, cause this intestine motion: most

probably they would prove to be carburetted hydrogen, carbonic acid, &c. the usual products of vegetable putrefaction—but the quantity is certainly extraordinary.—[*Edit.*]

6. *Optical Trap.*

[Communicated.]

To the curious it may not be uninteresting to be informed, that an ingenious sportsman in this vicinity (Newport, R. I.) has lately invented what appears to be an entirely novel mode of trapping birds, animals, &c. This seems to be founded on the principle of the fondness of many animals to associate with each other—and is effected merely by placing a common mirror in a suitable trap, so situated that the animal, in passing to and from its usual haunts, may see itself reflected, and is some how or other curiously impelled to approach the glass, and consequently entrapped—for instance, in order to take minks, muskrats, &c. a common box trap is made use of, with a mirror at the extreme end, (opposite the mouth) this being placed on the margin of a river, or pond of water, frequented by them—they will necessarily see themselves in it, and, like Narcissus, fall in love with their shadows, and are instantly taken. The inventor has not only been successful in taking the above animals, but he assures me that he has recently caught rabbits, and partridges, in one of this construction, and that no less than two dozen mice were taken in one night, without any other *bait*. W.

Remark.—We believe that this mode is not entirely original, as we have seen the same thing represented in a print, only the game was a tiger.—[*Ed.*]

7. *On the conducting powers of various bodies in relation to radiant matter.*

Extract of a letter to the Editor, from Dr. Hare, dated Philadelphia, May 17, 1822.

"I have found anthracite a tolerably good conductor of the principle evolved by the deflagrator, under those circumstances in which the indications of electricity uncombined with caloric, are very strong, as when the surfaces are subjected to water alone. In these cases it was indifferent

whether anthracite, or charcoal were used; but when the plates were exposed to diluted acids, there was no ignition so long as the circuit was completed by the former, while by the latter, it must be almost unnecessary to add, the most intense ignition was easily producible. This I ascribe to the high radiant power of charcoal, which I do not believe to arise from any peculiarity in its particles, but from its extreme porosity. When porous bodies are subjected to radiant matter, the latter has access at once to all the particles composing them, but when dense bodies are exposed in the same way, the exterior strata repel the radiant matter, or at most allow it to combine only with their surfaces. The same structure which facilitates the entrance, must of course favour the escape of radiant matter. In consequence of the high conducting power of metals, both as respects heat, and electricity, it were unnecessary that they should radiate in order, for the igneous fluid of galvanism to pass through them; but carbon being a very bad conductor of heat, is impermeable to that fluid, unless in cases where it contains little caloric, or where containing much of this fluid, circumstances will allow of its separating in rays. Hence, porosity in carbon is requisite to its ignition by the deflagrator. There can be no doubt, that a certain regularity of arrangement, operates like porosity, in favouring the passage of radiant principles. Hence, crystalline masses are often transparent, and glass rapidly receives, or gives out caloric and light."

8 *Spontaneous Combustion.*

(Communicated by Dr. Samuel Rockwell, of Sharon, Conn.)

" Late in the evening of the 2d of May inst. some of the family of Mr. Charles Elliot, of Sharon, Conn. observed sparks of fire to be blown over the fence of his back yard, from behind his barn, which was attached to a long row of buildings, viz, a hatter's shop, dwelling house, &c. The wind, at that time, being very high, and in a direction to carry the fire directly on to his buildings; Mr. Elliot and his family were immediately alarmed, and upon examination, found the fire in a heap of horse-dung, which had been flung out of the stable window. The fire on the top of the heap was about two feet in circumference, and there was a bed of coals and embers, for four inches in depth. The

whole heap was excessively hot, and the surface quite dry. The sparks were blown constantly by the wind against the barn, and the rubbish about it. Had it not been for this fortunate discovery, the buildings would very soon have been in flames, and the fire probably beyond control. After a careful examination, by a number of intelligent gentlemen, it was the decided opinion, that the fire originated from a spontaneous fermentation, and combustion of the dung heap. Had the buildings in the present case been burned, or even on fire, the heap would not have been examined or thought of, as the source of the fire, and it would have been believed to have been the work of an incendiary. The question arises, whether some of the instances which in towns, so frequently occur, of fire originating in stables, and which we attribute to incendiaries, may not in this way be accounted for."

9. *Geological Survey of North Carolina.*

We understand that Professor Olmstead of the University of North Carolina, will soon commence a series of geological and mineralogical observations, intended, eventually, to comprehend a scientific survey of the State. From the known intelligence, zeal and scientific attainments of Professor Olmstead, we cannot doubt, that *(if adequately encouraged by the local government, or by patriotic individuals,)* the enterprize will produce very important advantages to science, agriculture, and other useful arts, and will prove highly honorable to the very respectable State of North Carolina. In no way, in our apprehension, could the same sum of money be more usefully expended, and it would be no small honour to have set the first example of the scientific survey of an entire American State. We hope then to see the next edition of the map of North Carolina present at least the leading features of its geology and mineralogy. It would be very desirable also that the Botany, and if practicable, the zoology of the country should be investigated at the same time.

10 *Voluntary Breathing.*

A correspondent suggests, that where the lungs are unusually inactive and breathing very feeble and languid (as occurs both in cases of deep thought and of mental vacuity) respiration, increased both in frequency and degree, by a voluntary effort, gives a quicker circulation to the blood, and an increased activity to the animal spirits. He thinks that in some instances, where he has felt an oppression approaching to pain, in the region of the lungs, he has found himself much relieved by breathing quicker and deeper, and he even conceives that this voluntary effort may become a partial substitute for the respiration of oxigen gas.

11. *Proffessor Eaton's Geological, and Agricultural survey of Rensselaer County. Dr. J. H. Steel's report of the Geological structure of the county of Saratoga.*

We noticed (page 239, vol. III.) the geological survey of the county of Albany, by Mr. Eaton and Dr. Beck. We have now the pleasure of mentioning the survey of two other contiguous counties. The design reflects much honour upon those enlightened and patriotic persons, who appear as the patrons of the undertaking; and the execution is marked by so much fidelity, and ability, that we think the effect must be to encourage similar attempts. Geological surveys, more or less extensive, have been undertaken with creditable success, in various parts of this country, but we are not aware of any attempt on so extensive, and systematic a scale, to make them subservient to the important interets of agriculture. It was very natural to look for so good, and honorable a precedent in the most powerful state of the national confederacy, distinguished as it is by enlarged views, and great and useful enterprises.

We have neither time, nor space, in concluding the present number, to do any thing more than to recommend the report of Professor Eaton, and of Dr. Steel, to the perusal of all those who are willing to promote some of the best interests of their country, by making science the handmaid to the arts.

12. *Yellow mineral from Sparta, N. Jersey, imbedded in white granular limestone.*

We understand that a detailed analysis of this mineral, which was discovered by the late Dr. Bruce, will soon be published by Mr. Henry Seybert, of Philadelphia, whose experiments prove it to be a *silico-fluate of magnesia.*

We are obliged, for want of room, to postpone an article containing a collection of facts respecting the meteor of March, and some previous meteors.

Explanation of Mr. Barnes' Section of the Canaan Mountain.

a. Graywack slate.
b. Clay slate.
c. Quartz.
d. Limestone.
e. Graywack slate. This rock caps the high hills.
f. Clay slate. This rock is found on all the adjacent hills of a middling height.
g. Quartz. This rock is found on low hills, in loose masses.
h. Limestone. In this stratum are the springs of New-Lebanon, and the lead mine in Canaan.
i. Roofing slate.
j. An old field.
k. k. k. Outline of the top of the mountain.
l. l. Inaccessible precipice.
m. Fallen fragments of rocks.
n. n. Cultivated fields.
o. o. o. Probable position of a stratum of graywack rubblestone, now disintegrated, and found in loose fragments in the valleys below.
p. Samuel Jones', Esq. on Chesnut-Hill.
q. Peat bottom.
q. q. Alluvion.
r. Captain N. Jones'.
s. N. Lebanon meeting-house.
t. E. Tilden, Esq.
u. u. Pool hill, (limestone.) New Lebanon spring. Hull's boarding house.
v. v. Shakers' Village.
w. w. Line of the States of New-York and Massachusetts.
x. x. Line of section.

THE

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JOURNAL OF SCIENCE, &c.

GEOLOGY, MINERALOGY, TOPOGRAPHY, &c.

Art. I.—*Outline of the Mineralogy, Geology, &c. of Malbay, in Lower Canada, by* John S. Bigsby, M. D. *of the British Medical Staff.*

To the Editor of the American Journal of Science.

Dear Sir,

I very respectfully beg your acceptance of a sketch of the geology of Malbay in Lower Canada.

In the Summer of 1821 I devoted three weeks to the study of the geology of the highland districts below Quebec, on the north shore of the St. Lawrence, which, in the magnificent forms of their mountains, the beauty of their secluded but populous valleys, and in the affectionate simplicity of their inhabitants, give us a Switzerland in America.

In the present paper the topography, geology, and consequent remarks are placed separately after the manner of Dr. Maculloch, in his account of the Western Islands of Scotland, a work which has given its author unrivalled preeminence in geological description and discussion.

I was only five days at Malbay, but they were well employed. I regret that my statements of elevation are but conjecture; being provided only with a hammer, a compass and some sulphuric acid.

The accompanying outline or diagram of Malbay is from the eye, and is intended to impart merely a general idea of the locality. [See the plate at the end.]

Murray or Malbay is a rounded indenture in the north shore of the St. Lawrence, ninety miles below Quebec.

It is a basin, about half a league in diameter, closely invested by a semi-circular range of lofty hills, with irregular and pine-clad summits, and grassy declivities, chequered with the white dwellings of the peasantry. A considerable breach in the middle of this elevated Belt (near which stands the church and a cluster of houses) permits the passage of a noisy river into the St. Lawrence, and discloses in the rear, an ascending country, occasionally distributed into farms ; and supported in the distance by lands of a grand and picturesque outline.

These hills, or mountains, are divided into three distinct portions, occupying respectively the western, middle and eastern sides of the Bay.

The western hill, like the others, is a bluff continuation of the mountain groupes in the interior. Its height is from eight hundred to one thousand feet. The upper parts are broad and protuberant, and are covered with fractured rocks and dense vegetation. At the outer angle of the bay, they dip at once in a dark shattered precipice two hundred feet high, which extends outwards for half a mile (west) a little beyond a thready cascade, and then shelves into a slope of large ruins, either advancing into the St. Lawrence, or resting on low mounds of uninjured gneiss. Inwards, the precipice is replaced by alluvion, clothing the whole declivity which faces the basin, in two or three terraces, frequently broken into knolls, and excavations, or indeed, nearly obliterated by rains and periodical torrents. These irregular deposits preserve nearly the same height ; that of the upper terrace being from three to four hundred feet,—and the lower ones varying from twenty to eighty feet.

Their breadth is small at the outskirts of the bay, but it increases, at the bottom, (from a rough estimate) to seven hundred yards. This latter space is principally taken up by the lowest tier, and presents, among its pasturage and cornfields, a singular and beautiful assemblage of small detached oblong eminences, fringed, and crowned with shrubbery, and greatly resembling the Barrows of the earlier periods of Britain. They are the deposition of conflicting currents of water.

The Middle Hill, from six to eight hundred feet high, is a projecting portion of that on the west, just described, with which it is connected in front by almost perpendicular steeps of sand, clay, and gravel, but grassy, and intersected with deep ravines, filled with coppice, through one of which the Ruisseau de Mayou descends towards the Bay, turning several mills in its course.

As in the former case, the greater part of this hill is buried in alluvion. The upper third is covered with wood, while the imperfect scalar platforms below are apportioned into farms, and furnish sites for dwellings, especially the large and hospitable Seigniorial house of Mrs. Nairne. The eastern face of the hill breaks off almost percipitously to form the defile or river-pass before mentioned, and runs west for six miles as one of the sides of the valley of St. Etienne.

The eastern arm of Malbay is rather shorter than the other, and passes almost insensibly into the general course of the St. Lawrence. It rises along the shore in a waving line from the river-pass, and forming several lofty bluffs, with abraded faces it attains the height of eight hundred feet in a broad summit, mingling to the eastward with the high and rocky country about Cape Eagle. A precipice two hundred feet high, lines the shore for five hundred yards, just at the outside of the Bay, succeeded to the east. by shattered cliffs, slopes of debris, or smooth mounds within the influence of the tides.

The whole space included by these three hills is overflowed only at high water, which then washes the naked banks on the east, passes, (if I recollect aright) a short distance within the breach, and wanders among the marshy indentations of the west side in shallow and winding channels. At ebb, the Malbay River flows sluggishly through the moist sands to join the St. Lawrence at the skirts of the Bay.

The valley of St. Etienne, entered by the defile of its river, ascends northwardly for six miles, and is a straight rugged, and narrow stripe of low land, occupied principally by the ever changing bed of its stream. It is bounded on the west by the Middle Hill ; and on the east by the uplands which ascend swiftly into neighbouring mountains, greatly intersected by broken ridges of alluvion, and furrowed by water-

courses joining the river obliquely, and at seasons inundating it with their contents.

About five miles up the valley, a circular expansion of half a league in diameter takes place to the west, from the sudden bending to the north-west of the east face of the Middle Hill. This cavity rises, bowl-shaped, on every side, to the surrounding heights; at first, partially and confusedly, but higher up, in two or three concentric terraces, much injured by natural causes. A streamlet passes through its centre, in a deep woody dell, to join the Malbay river.

On the eastern uplands, about five hundred feet above the present bed of the River Malbay, a flat and uniform embankment extends the whole length of the valley, abraded at intervals by torrents. At a certain distance below this range, another is situated, parallel, and marked with corresponding breaches. It declines rapidly, and is succeeded by the broken ground, and barrow-like tumuli of clay and gravel—which immediately overlook the river, and on which are placed the fields, gardens, and dwellings of the parish St. Etienne.

One breach, affecting equally all these plateaux, is so large and deep, and so regular in its form, that it resembles in the strongest manner, the deserted bed of a river of magnitude, about to add its waters to those of the lake, contained in the valley at some distant epoch.

The west side of the valley exhibits the same appearances in the steep bank of alluvion four or five hundred feet high, resting on the Middle Hill. This answers to the highest eastern level, and is followed by the inferior terraces; although much disturbed and degraded.

The Malbay river rises near the sources of the St. Maurice, which discharges into the St. Lawrence, ninety miles above Quebec. During its course of several hundred miles through the marshy plains and rocky elevations of the interior, it presents many cascades and rapids. The lowest of the cascades takes place near the sortie from the confusedly grouped hills at the head, or north end of the valley. The river is here about fifty yards broad; it is clear and rapid, with shelving banks of sandy soil, an hundred feet high. A bleak and lofty hill of primary rock is within a few yards on the east; and another is on the west, still higher, with flanks enveloped in alluvion. Up the river.

the view is immediately shut in by a transverse ridge of gneiss.

The fall is narrowed to the breadth of thirty yards and plunges down an inclined descent of ten or twelve feet among large masses of gneiss.

The river now rolls impetuously to the defile inclosed in very deep banks, making frequent and considerable elbows (which every spring enlarges) and branches off into channels, which from time to time coalesce, and separate, forming islands of woods, sand, or cornfields ; the different streams being traced with double borders of shrubbery.

Somewhat less than a league to the north of the circular expansion of the valley, and separated from it by high grounds in some state of cultivation, is a lake about a third of a mile in diameter, surrounded by interesting scenery.

It is confined on the east and south by precipices and bold slopes of cedar and pine ; while its western and northern sides are moderate ascents of woodland and farms, closed, in the distance by conical mountains.

Two or more miles north of this small lake is another, seated in the midst of woody hills of gentle acclivities and marshy intervals. It is of irregular shape, and about three miles across, in its largest dimension.

A small stream enters it on the north, and another leaves it on the south. Both lakes contain abundance of trout.

The Geologist will find in the district of Malbay, an instructive assemblage of rocks ; but, as must have been anticipated, its examination is greatly embarrassed by the uncultivated and often inaccessible nature of the country, by the piles of the larger ruins which encumber the higher grounds, and by the alluvia of the slopes and valleys. The shores of the St. Lawrence, and of the Bay, the sides of the vale of Etienne and the bed of the Malbay river afford almost the only points of observation.

The prevailing rocks are gneiss and mica-slate, plentifully interleaved with a dark limestone, quartz rock, and supporting a calcareous conglomerate of a remarkable kind.

As the rocks of this limited district are nearly of the same age, (excepting perhaps the conglomerate) I shall describe them geographically, and not in any assumed geological succession, commencing with the West Hill.

As far as can be discerned, the body of this hill consists principally of fine white Gneiss, with a sparing proportion

of mica in its composition, this resembling quartz rock, into a semi-crystalline species of which, it frequently graduates, as well as into mica slate, by an increase, on the other hand, of mica.

So little of the gneiss is exposed, that it may be doubted, if the greater portion of it be not of the ribbed or laminated variety, abounding, for many miles on the north shore of the St. Lawrence.

Together with these rocks, a dark limestone occasionally emerges in very short patches, conformably stratified, some yards in thickness, and in one instance incumbent on a crystalline quartz.

The direction of the strata of the body of the hill is seldom easily definable, being brought into view at rare and brief intervals.

It appears to be west south west, at an high, but uncertain angle. Innumerable fissures and displacements of the fixed rocks, together with an extraordinary quantity of debris, have given rise to this obscurity.

A better idea of the structure of the hill, may be gathered from its southern face washed by the St. Lawrence; and from the angle and west arm of the Bay, situations which permit the observer both to follow and to traverse the direction of the strata.

The rocks of the cliff and tubes whose most prominent features have been sketched in an early part of this paper are mica slate and gneiss, affecting the southwest, or south south west direction, and a south west or north north west dip.

They pass into each other at irregular distances, as well longitudinally, as transversely. The transition takes place insensibly in the former direction, the mica slate becoming more compact, and assuming a green hue, which slowly fades into a brownish grey. The rock thus formed, is a laminated gneiss, composed of feldspar and quartz, both brown, almost granular, alternating in their layers with folia of black mica, in laterally aggregated scales. Its veins are numerous and various. They are of largely crystallized white feldspar, interspersed with black mica, and running parallel to the stratification of the gneiss;—or of true granite, traversing the rock irregularly, close-grained and porphyritic in portions, the feldspar being red, and the quartz white. About four hundred yards from the angle of

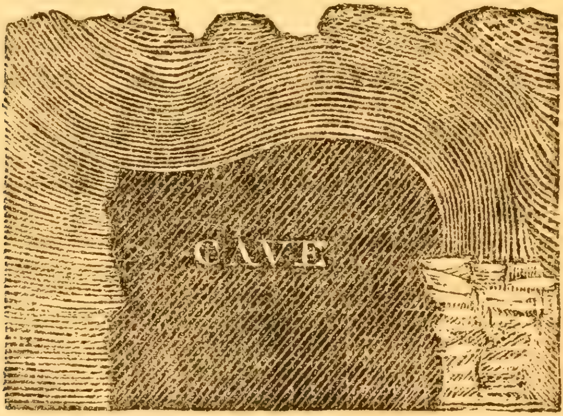
the bay, a vein one yard thick, of brown compact quartz, advances from the cliff at right angles, to the direction of the gneiss, and diminishing to a point at the water's edge, the line of division being straight, and perfectly well defined. It is remarkable that a few leaves of a crumbling, shaly substance, are interspersed between the vein and its bed, and are parellel to the former. In contact with the west side of this vein, is a deposit of white feldspar in large aggregated rhomboidal crystals. It is of an irregular form, and is about 50 yards long, by 40 yards broad. Fifty yards west of the small cascade, a bed or seam of this kind of feldspar occurs in laminated gneiss; but it is narrow and runs obliquely from the beach into the mountain—visible as a stripe of white fragments for a considerable distance among the ruins of the slope.

The mica slate is in large shining plates of a coppery black colour. It is very splintery on the surface; but not so much so in the occasionally broken pavement of this rock in advance of the cliff to which the salt water has daily access. The mica is often in such great excess, as to exclude every other ingredient, except what appears to be a minutely granular quartz, sparingly disseminated.

The layers are often contorted, and are traversed by veins of different materials, and of different sizes—as of white crystalline quartz; red feldspar; of an aggregate of greenish feldspar, coppery mica and massive garnet: and also of white feldspar similar to that of the beds occurring in gneiss, which here contains six sided prisms of schorl, and four sided oblique prisms of hornblende. In the last instance, the veins are parallel to the laminæ of the mica slate; but in the others in their direction is inconstant.

The gray precipice which forms the immediate angle of the Bay, a few yards in advance of the dark lichen covered primary cliff on the west, is of a similar height with it; but is surrounded by a level space, and not by this usual declivity. At the outer or western end, it sinks perpendicularly down to the beach, unincumbered by debris; but at every other part of the line it is defended from the waves by a base of smooth and bleached mounds of rock, half concealed by fallen masses, mounting midheight and towards the northeast extremity becoming mingled with alluvion, which gives nourishment to a luxuriant shrubbery.

The conglomerate composing the chief part of this precipice, is in strata a foot or more in thickness, abutting against the mica slate in various unconformable positions. At the west end, the layers are very thin, and are placed vertically, with a southwest direction, in some degree of parallelism to the contiguous mica slate. Near this they are contorted, until gradually toward the centre of the range they become horizontal. Here a singular disposition of the upper laminæ is observed. They roof a shallow cave in undulating



lines, which descend gently from above, and after curving upwards for a short distance, decline suddenly on the horizontal strata which constitute the lower half of the sides of the cave. From hence to the north-east end, the cliff seems rather to assume the massive structure than the stratified, but the latter frequently shows itself through its dense envelope of mould and coppice.

In advance of this large precipice, and its northeast extremity, lies another mass of conglomerate extending a short way from the alluvial sides of the hill, fifty yards long, and thirty feet high. It is much shattered and deranged. The direction of its layers is very indistinct. On its east face, a set of strata (perhaps displaced) run west of north, and dip east of south at an angle of 70°.

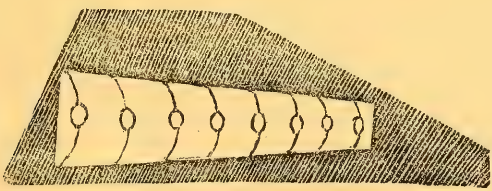
The rock whose position and general aspect has now been detailed, is a conglomerate of a grayish white or

green base, effervescing violently on exposure to acids, and more or less powdery and soft. The nodules which it contains are of milky translucent quartz; and vary from the size of the smallest grain, to that of a child's head; the latter being rare.

They are sometimes so abundant as to be in contact; at others they are in less number. When large, they are frequently arranged in lines. The small granular species resembles in its appearance a loose sand stone; but when of compact texture and free from nodules, it becomes a brown limestone. It often contains imbedded balls of a brown calcareous matter, hard, and of fine grain. It is evidently an independent concretion.

This rock and more especially the coarse grained species, is rich in organic remains of the kind assigned by writers to the transition formations.

A very slight examination discovered four varieties of orthoceratite, in imbedded fragments, differing in the number and construction of their transverse septa, and in the proportion of their length to their breadth. Three of them taper towards one end. The sides of the fourth are parallel. One fragment is three inches broad, seven inches long, and has eight septa. Another is six inches long by one inch in breadth, with five transverse septa and one longitudinal septum dividing it into two equal parts. A third is five inches long, by one and a half broad; and has eight septa, each having a ring or circlet in its centre thus :—



Favosite and chain madrepore are not uncommon. Encrinites, pectinites, terebratulæ and strombites are particularly plentiful.

The dull brownish blue Limestone, so often instratified with the primary rocks of these mountains is also inclosed in this conglomerate, in single layers, a foot or so thick, or

in sets of ten or fifteen. It is compact, minutely granular, and rather hard. Its fracture is slaty in the large, rhomboidal in the small. It gives a sulphureous odour on percussion, and here and there contains a few shells. Its layers sometimes gradually dilate, or belly out, in portions, and contain some form of the general conglomerate of the cliff. It even occasionally takes the fine crystalline texture of the Limestone of Montmorenci or Point aux Trembles: but this is rare.

A brown or black splintery slate is often interposed between the conglomerate and the dark Limestone; and is plentiful at the Cave.

I had no opportunity of examining the higher parts of the West Hill skirting the Bay: by far the greater portion of it is buried, as before stated, in irregular terraces of alluvion. The breach, however, below, exhibits intervals of the less durable calcareous rocks of the west angle, and not of the primary strata of the Hill, as might have been expected.

At each end of this arm of the Bay, small quantities of the conglomerate are met with;—not to be distinguished by the eye, from Grey wacke, on account of the faint green colour of its base.—Near the outer precipice, it is much interleaved with the dark limestone; and contains a few shells.

In a grassy meadow, near the church, a more compact form of the conglomerate emerges from the soil in slabs inclining to the south-south-west at an angle of 25°, a dip which I believe to be accidental from the extreme disorder of some contiguous strata of dark Limestone. There is another portion at the foot of the Middle Hill, near some low mounds of porphyritic grey gneiss.

Several patches of the dark Limestone occur on the beach, two of them being four or five hundred yards in length.

Like the Mica-slate of the Hill, it dips to the north-north-west at an high angle, excepting the large mass alluded to above, which inclines, in groupes of strata, in every possible direction.

I did not observe any organic remains in the Limestone here, nor other accidental mineral, excepting white calc spar, which often traverses the rock so plentifully in slender veins, as to give it a brecciated appearance.

The alluvion of the Middle Hill suffers but few strata to shew themselves. Those at the back of the cluster of houses, near the church, are the gneiss and calcareous conglomerate just mentioned.—The dark Limestone is the only rock I met with on the east side of this Hill, or that flanking the valley of St. Etienne.—For six miles it is seen at all levels; but in the clearest manner, in the numerous gullies and in the banks and bed of the river. About four miles from Malbay Church I traced it in a gulley on this side of the valley for four hundred feet. It is there usually disposed horizontally; but it is in many places inclined.—Near the top of this height, it wears the rounded, smooth, and dough-like shape of water-worn granite, together with great indistinctness in the divisions of the Laminæ.

With respect to the rocks in the more remote interior, it may be here remarked, that the incumbered state of the surface is such as to preclude any examination of them.—At the lesser lake, they are primary; and also in the neighborhood of the first fall in the Malbay River, where they are coarse and shattered gneiss running south-south-west, and vertically, I believe. In one example, it contains a vein of chlorite, running parallel to its stratification.

The rocks of the Eastern Hill are also greatly obscured by the alluvion of its sides; and by the dense vegetation and debris of its summit; but in the latter situation, where it overlooks the Bay, occasional ridges of white quartz crop out and run nearly north. The texture is crystalline, but now and then becomes granular; and even of a conglomerated form.

The rocks of the high and naked grounds in the rear of this, appear, on distant inspection, to be primary; but as in a former case, the shores at the base of this hill will best elucidate the geology of this locality.

A shingled beach skirts the east side of the Bay, but at the point where the shore first inclines strongly into the general course of the St. Lawrence, a rapid succession of rocks takes place.

The first met with, is a collection of strata of knotty greenstone, with a south-west direction and a dip, either vertical or to the south-east. It is much veined by true granite, containing hornblende and garnet. This greenstone extends along the beach for 150 yards, and gradually becomes gneiss, (towards the hill it is immediately buried

in alluvion.) An interval of shingle having taken place for fifty yards, a nearly pure quartz follows, much fractured. It retains the south-west direction and the south-east or vertical dip, and extends for 100 yards, protruding from the contiguous hill, whose summit is composed of it.—Now and then it is seamed by a dark quartz, mixed with mica; the walls of the seam being very ill defined.

Close to this, (proceeding eastward along the beach,) covering and intermixing with it, is a horizontal stratum of of quartzose puddingstone, with small scales of white mica. It soon passes into the form of the calcareous conglomerate and contains a few shells. It is only an insulated fragment, ten feet broad, by five in height, probably incumbent on the vertical quartz, which is now resumed for twenty yards, when it disappears under the shingle.

One hundred yards to the east, there is a low tongue of land, about three hundred yards across, and two hundred long. Its beach is wholly occupied by the dark limestone, its strata dipping in long undulating curves, or in short broken masses in every imaginable direction. This limestone possesses a few shells, and has many knotty protuberances, six inches high, by a foot or more in diameter. Their surface and interior are marked with indistinct appearances of the capillary sea weed, which, fixed to some rock, streams in the tide.—Large globular concretions are abundant, similar to those in the white limestone of Lake Huron, and of composition similar to that of the containing rock.

In the rear of this projecting point, and somewhat to the east, is a gentle alluvial ascent, crowned by broken ledges of calcareous conglomerate, passing into sandstone;—themselves again surmounted by a steep round-backed hill.

Passing eastward a very short distance, we find the sea encroaching gradually on this alluvial ascent until it bathes the foot of its conglomerate ledge, which now, two hundred feet high, forms the immediate shore, fronted, and half buried by the usual pile of ruins. Its west end is not far from the last of the confused layers of limestone, where it becomes now and then interleaved with a browner and somewhat crystalline limestone; and still nearer, with the green variety of the conglomerate so closely resembling grey wacké, both rocks observing the accidental direction of the accompanying strata.

The face of the precipice is nearly perpendicular; the upper parts overhanging a little; and the layers undulating, but never departing widely from the general horizontality of the rock.

The cliff is of a mixed character. Near the east end a fissured mass of porphyritic granite twelve feet high, and as many broad, rises from the loose sand of the beach, and passes under the precipice, into the hill. Near it, but not in contact, a coarse quartz rock does the same; but not attaining more than four or five feet above the level of the water; and is surrounded by broken strata of the green conglomerate lately spoken of, which covers the beach along the whole front of the precipice.

The cliff itself is composed of calcareous conglomerate, interleaved with a brown limestone, as in that of the west angle of the bay:—the only difference which I observed is, the predominance of the conglomerate in the lower parts, and of the limestone in the upper; which latter is brown, and remarkably full of shells. I observed an orthocerite with a pointed termination; but in other respects similar to those previously noticed: I do not recollect whether it occurred in the conglomerate or in the brown limestone, rocks which perhaps differ only in the presence or absence of quartz nodules.

The conglomerate is occasionally interspersed with small rounded flakes of black clayey matter, as in the grey wacke of Ange Gardien, and of Cap Rouge, near Quebec.

The precipice is discontinued suddenly, and is replaced to the east by a slope of gneisic ruins. On the beach a whitish laminated gneiss prevails at various angles of inclination, but always dipping north north-west under the hills. The mica of the gneiss, as we proceed east, very gradually increases, and hornblende and garnets in crystals become numerous. At length the rock is changed into a coarse black mica slate. The garnets now for several hundred yards towards Cape Eagle are so abundant as to form the greater part of the rock. They are either obscurely crystallized or massive;—instances of either form eight inches in diameter being common. Their texture is much loosened by rents; and many have fallen from their nests: It is difficult to procure large specimens from their frangibility, and from the toughness of the rock in which they are imbedded.

This mica slate is often tolerably compact. It is full of quartz veins, and of the beds of white feldspar, as on the outside of the west arm of Malbay. Its layers are, as is usual, very tortuous, but like the gneiss, they affect on the whole the north north-west dip.

Half a mile from the conglomerate precipice the gneiss is resumed, and continues for a great distance to dip into the water in impassable mounds. I observed it at the Riviere des Trois Saumons, nine miles below: where it has a transverse vein of calcspar, mottled white, green, and red, eighteen inches thick, and intersected obliquely by a vein of white quartz six inches thick.

The details which have now been entered upon at some length. suggest the following observations :—

The rock formations of the north shore of the St. Lawrence from Cape Torment, a precipitous headland 1,800 feet high, to the River des Trois Saumons, are of a character similar to that of the district of Malbay. They rise into mountains of magnificent features, which bound the river in lofty capes and escarpments, and at distant intervals break into rich but narrow valleys of alluvion, the outlets of streams tributary to the St. Lawrence.

Almost all the primary rocks are found in this distance alternating in rapid succession, and thus contrasting in the most forcible manner with the vast and monotonous tracts of gneiss, limestone, and marble of Upper Canada.

The rocks of Malbay are, with one exception, of the ordinary kinds, but they are remarkable in their transitions and position.

These transitions are effected in different ways, as gradually and longitudinally (that is, in the direction of the stratum) in the primary rocks, one ingredient mica for instance, slowly predominating to the exclusion of another. Thus the laminated gneiss of the West Hill becomes well characterised mica slate, and by the addition of hornblende, undergoes a still greater change in the east of Malbay. This appearance has been rarely noticed by authors. Dr. Maculloch met with it in the Isle of Sky in the West of Scotland, and considers it to be of difficult explanation, but shews it to occur in other formations. Professor Kidd

gives a striking instance of it in the secondary rocks of England.

The transverse and more common mode of slow transition is present every where.

The sudden alternation of entirely dissimilar strata, as of gneiss and limestone, is frequent. It is strikingly exemplified in the channelled fissure of some extent, which a mountain stream has worn in the face of a precipice at the Bay of St. Paul, thirty miles west from Malbay. In the walls of this fissure or gulley, conformable layers of these substances alternate several times in the space of eighty yards. They incline to the west south-west at an angle of 70°. The limestone has occasional seams of white crystalline marble, beautifully clouded with green, and containing disseminated galena. These rocks are unchanged at their well defined point of contact.

The frequent alternations of the gneiss, quartz, limestone, &c. of Malbay, shews them to be of the same age; it is remarkable however that the limestone of the highlands and the dark conchiferous species of the beach are quite similar in composition, although of very different dates, a fact which involves nothing absurd or even improbable, as almost every rock in the geological catalogue recurs at intervals, and with the same characters.

The limestone appears to occupy the flanks of the hills. I never saw it higher on the north shore, than 800 or 1,000 feet above the sea. The summit of the mountains is always primary:—that of Cape Torment is of the finest graphic granite.

While these strata affect more or less a south-west direction, they do not enwrap or abut upon the mountains, but dip towards them,—a very extraordinary disposition, of which I know but four instances. It was noticed by Saussure on the Grimsel and in the valley of Chamouni.

Von Buch met with it in the primitive mountains of Norway; and Macculloch, also, in the western islands of Scotland. This dip extends along the north shore of the St. Lawrence for thirty miles, and is the more singular from being surrounded by rocks of the opposite inclination.—Almost all the older rocks of the Canadas have assumed the latter position, as the primitive rocks of the Thousand Islands near Kingston, and those on the north and east of Lake

Huron, and the greywacke, clay slate, and quartz rock of the south side of the St. Lawrence from Camourasca to Quebec, together with the gneiss of Montmorenci, Auge Gardien and Cape Torment.

The marble, greenstone, and large grained gneiss of the River Ottawa run somewhat more westerly, but they are so obscured by weathering, alluvion and vegetation, that it is difficult to detect their real position.

From the rocks of Malbay and Camourasca, two opposite points in the south and north shores of the St. Lawrence, being totally different, this river seems to bound or separate two formations, as Von Buch observed in the fiord of Christiana in Norway, and elsewhere, and as is the case with Lakes Superior and Huron in Canada.

The calcareous conglomerate of Malbay presents several peculiar appearances.

Its resemblance to greywacke in its associations and external characters is so perfect that for some days I considered it as such, but was undeceived by its violent effervescence on exposure to acids.

This rock is also interposed between the black fetid limestone and the gneiss of the Falls of Montmorenci, and in all probability passes into genuine greywacke as the latter is formed in horizontal strata less than a mile to the east of the Falls, and nearly at the same level. The grey wacke likewise occupies the south-east of Quebec in large tracts.

The Pictured Rocks of Lake Superior, so splendidly described by Governor Cass in his notes to the poem of Ontwa are of this substance.

At Malbay it is unconformable to the primary rocks on which it abuts, and is perhaps the most recent, from, in addition to its horizontality, its containing organic remains and water-worn nodules.

The curvature of the strata at the cave in the west angle of the Bay, and of the east shore of the Bay, is worthy of observation. They are an additional evidence shewing the temporary flexibility of rocks, after consolidation, and their disturbance while in that condition. The most singular contortions on a large scale, that I recollect, are the curved gneiss of the Western Islands, figured by Macculloch, and the almost spherical limestone discovered at La Forme in Switzerland, by Dolomica. At the mouth of the

River Grand St. Anne, 24 miles below Quebec, three strong seams of gray wacke form as many concentric arches, in the face of a naked and perpendicular bank, the outer of which is about eight feet high, and twenty-two feet span. The surrounding shale observes the same position.

At the bridge of the river Jaques Cartier, 30 miles above Quebec, there is a beautiful natural arch of blue limestone of similar dimensions.

The occurrence of comparatively uninjured organic remains in a minute conglomerate is a remarkable circumstance, and shews that the shells, encrinites,* and orthoceratites have not been subjected to the same attrition as the quartzose nodules.

These orthoceratites shew in what a qualified sense must be taken the rule which determines the æra, and other relations of rocks from their contents. Parkinson, Greenhough, and Kidd, have expressed an accordance with this opinion, without entering into proof. My own experience in North America, leads to the same conclusion. The orthoceratites are astonishingly numerous, large and varied in the greenish grey and brown limestones of Lake Huron, in the yellowish grey of Lake Erie, in the blackish blue of the northern and southern shores of Lake Ontario, and of the Falls of Montmorenci, in the brown and lead-coloured beautifully crystalline variety of Point aux Trembles, and Jacques Cartier, ten leagues above Quebec, and lastly in the calcareous conglomerate of Malbay—substances of marked dissimilarity under every aspect, geological and mineralogical.

The alluvial depositions which have been noticed in the romantic valley of St. Etienne, attract particular regard only from their quantity and regularity of disposition. They furnish a most gratifying and instructive lesson to the young geologist, and seem to indicate four conditions of the river Malbay, with respect to size, each (it may be supposed) being assumed, successively from the highest, as the barrier between the valley, and the St. Lawrence, has received some great injury.

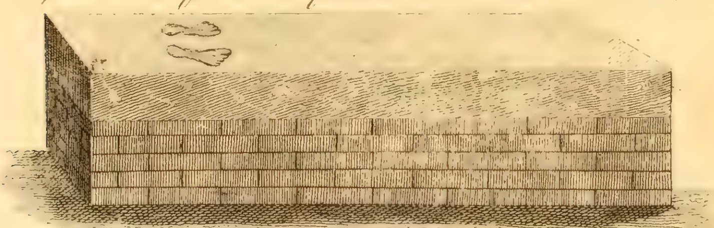
* It is singular that no lily encrinites so numerous in England, have been found in the vast secondary tracts of North America. I know only of one Echinite also—from Onondaga, New-York, I believe. It is in possession of J. G. Bogert, Esq. New-York.

They are clearly the work of the present river; but when its bottom and surface have been at very different levels from the present. The country to the north west, from whence the materials forming these hills have been drawn, is not universally, as Hayden, in his spirited, useful, but ill-digested work supposes, naked, and soil-less from the devastations of a debacle, but abounds in alluvial plains of immense extent, and some so fertile, as to have induced the Jesuits to plant gardens and vineyards there, as on the low rich banks of the Lake St. John, of the Saguenay River, Lake Tematscaming, and in the rear of the mountains of Malbay and St. Paul, to the last of which situations, the Canadian peasantry, sluggish and unobservant as they are, were induced to remove. The length and severity of the winter, however, and the solitariness of these wild regions, have compelled them to return to their friends around Quebec.

The great primitive floods, appear to have been in some measure partial; their force and direction being modified by the nature of the ground over which they flowed. Thus, much of the northwest is a vast assemblage of debris, without soil, and without vegetation, as on the River des Francois, the coast of Labrador, and the barrens of Hearne. It is singular that among the incalculable quantities of detached rocks which load the district of Malbay, I met with only two specimens of the clay slate of Camourasca, on the opposite side of the St. Lawrence; and a similar number in the Eboulements, while in Upper Canada the jasper conglomerate of the Northwest of Lake Huron overspreads all the *high grounds* of that large body of water.

The epidotic Greenstones, the greenstone porphyries and other peculiar rocks of the same lake, are plentiful, as rolled masses in Lake Erie, at the foot of Lake Superior, the rapids of Hawksbury on the river Ottawa, an extent of country exceeding 1000 square miles. The trap of Montreal is found loose, on the shores of Lakes Francis and Champlain, localities to which the existing rivers could not have conveyed them, as their current observes the opposite direction. JOHN I. BIGSBY, M. D.

Impression of Human feet in Limestone Rock. pa. 131.



Art. II.—*Remarks on the Prints of Human Feet, observed in the secondary limestone of the Mississippi valley.*

TO PROFESSOR SILLIMAN.

Buffalo, (N. Y.) June 5th, 1822.

Sir,

I now send you a drawing of two curious prints of the human foot in limestone rock, observed by me last summer, in a detached slab of secondary formation, at Harmony, on the Wabash; together with a letter of Col. Thos. H. Benton, a senator in Congress from Missouri, on the same subject. The slab of stone containing these impressions, was originally quarried on the west bank of the Mississippi river, at St. Louis, and belongs to the elder flœtz range of limestone, which pervades that country to a very great extent.

These prints appear to have been noticed by the French soon after they penetrated into that country from the Canadas, and during the progress of settlement at St. Louis, were frequently resorted to as a phenomenon in the works of nature. But no person appears to have entertained the idea of raising them from the quarry with a view to preservation, until Mr. Rappe* visited that place five or six years ago. He immediately determined to remove the stone containing them to his village of Harmony, then recently transferred from Butler county in Pennsylvania, to the banks of the Wabash; but this determination was no sooner known than popular sentiment began to arraign his motives, and people were ready to attribute to religious fanaticism or arch deception, what was, more probably, a mere act of momentary caprice, or settled taste. His followers, it was said, were to regard these prints as the sacred *impress* of the feet of our Saviour. Few persons thought of interpos-

* The Rev. Frederick Rappe is the ecclesiastical head of a religious sect called *Harmonites*, who emigrated from the kingdom of Wirtemberg, in Germany, about the year 1804. They first settled in Western Pennsylvania, where they introduced the cultivation of the vine. Their industry, sobriety, neatness, and orderly conduct soon attracted universal notice, but increasing rapidly in wealth and numbers, they afterwards (about 1814) removed into Indiana. H. R. S.

ing a charitable remark in favour of religious tenets, of which we can judge only by the peaceful, industrious, and devotional lives; the neat and cleanly appearance; and the inoffensive manners of those who profess them. Still less could be conceded in favour of a personal taste for objects of natural history or curiosity, of which this act is, at least, a proof. Be this as it may, Mr. Rappe contracted with a stone mason to cut out the block with the impressions, paying him at the same time a liberal price for his labour, and ordered it to be transported by water to his residence in Posy county, Indiana. Visiting this place during the last summer, in the suite of Governor Cass, Mr. Rappe conducted us to see this curiosity, which has been placed upon mason work in a paved area between his dwelling house and garden, in the manner represented in figure II. of the drawing.* The slab of stone thus preserved, forms a parallelogram of eight feet in length, by three and a half in breadth, and has a thickness of eight inches, which appears to be the natural thickness of the stratum of limestone rock, of which it is a part. This limestone possesses a firm and compact structure, of the peculiar greyish blue tint common to the calcareous rocks of the Mississippi valley, and contains fossil encrinites, and some analagous remains, very plentifully imbedded. It is quarried at St. Louis, both for the purposes of building stone, and for quicklime. It becomes beautifully white on parting with its carbonic acid and water, and those who have used it, observe, that it makes a good cement, with the usual proportion of sand.

The prints are those of a man standing erect, with his heels drawn in, and his toes turned outward, which is the most natural position. The distance between the heels, by accurate measurement, is $6\frac{1}{4}$ inches, and between the toes, $13\frac{1}{2}$ inches: but it will be perceived, that these are not the impressions of feet accustomed to a close shoe, the toes being very much spread, and the foot flattened in a manner that happens to those who have been habituated to go a great length of time without shoes. Notwithstanding this circumstance, the prints are strikingly natural, exhibiting every muscular impression, and swell of the heel and toes, with a precision and faithfulness to nature, which I have not been able to copy, with perfect exactness, in the

* See the Plate at the end.

present drawing. The length of each foot, as indicated by the prints, is $10\frac{1}{2}$ inches, and the width across the spread of the toes, 4 inches, which diminishes to $2\frac{1}{2}$ inches, at the swell of the heels, indicating, as it is thought, a stature of the common size.*

This rock presents a plain and smooth surface, having acquired a polish from the sand and water, to which its original position periodically subjected it. Upon this smooth surface, commencing in front of the tracks, there is a kind of scroll, which is two feet and a half in length. The shape of this is very irregular, and not equally plain and perfect in all parts, and would convey to the observer the idea of a man idly marking with his fingers, or with a smooth stick, fanciful figures upon a soft surface. Some pretend to observe in this scroll, the figure of an Indian bow, but this inference did not appear, to any of our party, to be justified.

Every appearance will warrant the conclusion that these impressions were made at a time when the rock was soft enough to receive them by pressure, and that the marks of feet are natural and genuine. Such was the opinion of Gov. Cass and myself, formed upon the spot, and there is nothing that I have subsequently seen to alter this view: on the contrary, there are some corroborating facts calculated to strengthen and confirm it.† But it will be observed

* These measurements were made July 19th, 1821, in the presence of His Excellency, Lewis Cass; the Rev. Fred. Rappe, the younger; and Maj. Robt. A. Forsyth, of Detroit. H. R. S.

† The following are the facts referred to. At the town of Herculaneum in Jefferson county, Missouri, two supposed tracks of the human foot were observed by the workmen engaged in quarrying stone in the year 1817. These impressions, at the time, attracted the general notice of the inhabitants, and were considered so curious and interesting that the workmen who were employed in building a stone chimney for John W. Honey, Esq. of that place, were directed to place the two blocks of stone containing these marks, in the outward wall, so as to be capable of being examined at all times. It is well known to those who have visited that section of country, that the custom of building the back walls and the pipe of the chimney, in such a manner as to project beyond the body of the house, is prevalent among the French, and other inhabitants; and consequently, the above arrangement, while it completely preserves, at the same time exposes the prints to observation, in the most satisfactory manner. I examined them in that position on my first visit to Missouri, in 1818, and afterwards in 1821, when I took drawings of both the prints. They are however the impressions of feet covered with the Indian shoe, and are not so perfect and exquisitely natural as those at Harmony. They were situated in the same range of secondary limestone, and distant from St. Louis, 30 miles.

by a letter which is transmitted with these remarks, that Col. Benton entertains a different opinion, and supposes them to be the result of human labour, at the same period of time when those enigmatical mounds upon the American Bottom, and above the town of St. Louis, were constructed. The reasons which have induced him to reject the opinion of their being organic impressions are these:

"1. *The hardness of the rock.*

"2. *The want of tracks leading to and from them.*

"3. *The difficulty of supposing a change so instantaneous and apropos, as must have taken place in the formation of the rock, if impressed when soft enough to receive such deep and distinct tracks.*"

To those who are familiar with the facts of the existence of sea and fresh water shells, ferns, madrepores, and other fossil organic remains, in the hardest sandstones and limestones of our continent, the *hardness* of the rock, and the supposed *rapidity* of its consolidation, will not present objections of that force, which the writer supposes.* But

Several tracks of the human foot are reported to exist upon the rocks between Esopus landing and Kingston, on the Hudson. Chas. H. Ruggles, Esq. Representative in Congress from Kingston, to whom I mentioned this report, has no knowledge of the fact.

A detached block of stone near the residence of Com. Rogers, at the city of Washington, has been frequently resorted to, on account of its bearing the supposed prints of the human foot. I have recently visited, and made a cursory examination of this stone, in company with Dr. Darlington of Pennsylvania, and Albert H. Tracy, Esq. of N. York, both Representatives in the present Congress; but am not prepared to describe it. H. R. S.

* The following interesting fact, touching the history of secondary rocks, has just come to light. The workmen engaged in blasting rock from the bed of the Erie Canal, at Lockport, in Niagara county, lately discovered in a small cavity in the rock, a toad in the torpid state, which on exposure to the air instantly came to life, but died in a few moments afterwards. The cavity was only large enough to contain the body, without allowing room for motion. No communication existed with the atmosphere: the nearest place of approach to the surface was six inches, through solid stone. It is not mentioned whether the rock was sandstone, or limestone; but from the prevalence of limestone on the surface of the contiguous country, it may be presumed to be the latter: the country is wholly of secondary formation. These animals have frequently been found imbedded in clay, gravel, &c. but no fact of their having been observed *in rock*, is recollected. Of the causes which enable animals of this class, which have been suddenly enveloped in strata of earth, or otherwise shut out from the air without injury to the animal organs, to resume, for a limited period, the functions of life, on being restored to the atmosphere, no explanation need here be given, as

the want of tracks leading to and from them, presents a difficulty, which cannot, perhaps, be so readily obviated. We should certainly suppose such tracks to exist, unless it could be ascertained that the toes of the prints, when in situ, pointed inland, in which case we should be at liberty to conjecture, that the person making them, had landed from the Mississippi, and proceeded no further into the interior. But no enquiry has enabled me to ascertain this fact, the circumstance not being recollected by Col. Benton, and others, who have often visted this curiosity while it remained in its natural position at St. Louis.

The following considerations, it will be seen, are stated by Col. Benton, as capable of being urged in opposition to his theory of their being of factitious origin.

"1. *The exquisiteness of the workmanship.*

"2. *The difficulty of working such hard material without steel or iron.*"

The strikingly natural appearance of these prints, has always appeared to me, to be one of the best evidences of their being genuine; for I cannot suppose that there is any artist *now* in America possessed of the skill necessary to produce such perfect and masterly pieces of sculpture: yet, what are we to say of the skill of that people, who are supposed to have been capable of producing such finished pieces of art, without the aid of iron tools? For, let it constantly be borne in mind, that the antiquity of these prints can be traced back to the earliest discovery of the country, and consequently to the introduction of iron tools and weapons among the aborigines. There are none of our Indian tribes who have made any proficiency in sculpture, even since the iron hatchet and knife, have been exchanged for those of flint, and of obsidian. All their attempts in this way are grotesque, and exhibit a lamentable want of proportions, the same which was seen in the paintings, and in the figured vases and pottery of the Asteecks

the occurrence is a very common one, and is perhaps always, more or less, the result of galvanic excitement. But one conclusion seems naturally to be suggested by this discovery: if secondary rocks, as Hutton and Playfair have taught, have been consolidated by fire, would not the animal here incarcerated, have been consumed, or at least, such an effect have been produced, upon the animal organization, as to prevent resuscitation? H. R. S.

of Mexico, when their towns and temples were first visited by the Spanish conqueror.

These remarks, and the papers which are designed to illustrate them, are submitted without further comment, in the hope that the novelty of the facts, at least, will recommend them to the consideration of those who take an interest in the geological antiquities of our continent, and whose opportunities of information qualify them for the discussion, in a manner that I cannot presume to be.

Yours, with respect,

HENRY R. SCHOOLCRAFT.

TO THE HON. THOMAS H. BENTON, OF MISSOURI.

Washington, April 27th, 1822.

SIR,

" Understanding that you have seen the prints of human feet in the limestone rock, which forms the western shore of the Mississippi river, at St. Louis, and that you entertain peculiar views in regard to them, I beg leave to solicit your reply as to the fact of the existence of those impressions, in situ, at the place indicated ; the time at which they were first discovered by the inhabitants, and the subsequent removal of the stone, with such opinion as you may think proper to communicate respecting their origin, and the conclusions to be drawn.

" It is very remarkable that no analogous appearances have been disclosed by the rock strata of any other part of the world : at least, we are not informed that any well authenticated discoveries of the fossil remains or impressions of man, have ever been made, which prove the existence of the species before the consolidation of existing rocks.* But such, it appears to me, is the inevitable conclusion to be drawn, if we are prepared to admit that these prints were produced by the pressure of the human foot upon those secondary strata, during their soft, or semi-pasty state.

" When we reflect upon the period of time which has elapsed since the Mississippi country has been known to

* The fossil human bones of Guadaloupe, are not conceived to form an exception to this remark. They are contained in a porous, shelly rock, or a kind of tufa, of very recent and local formation. H. R. S.

Europeans, and the great number of persons, both men of science, as well as men of business, who have visited the town of St. Louis since its transfer to the United States, it is not less remarkable that a circumstance so perfectly *unique* among natural objects, should not, ere now, have elicited that notice, which the increasing taste for natural science in this country, appears to claim for it. It is the more to be regretted that this inquiry has been permitted to sleep, until the stone itself containing these impressions, having attracted the attention of a religious sect, has been conveyed into a distant part of the country, and there preserved for purposes, which many are free to declare, are totally independent of all scientific considerations.

"The circumstances of this removal, and the insulated state in which only it can now be seen, leave room for doubts, respecting its original position at St. Louis, which no testimony less certain than that of an eye witness of the scene, is calculated completely to remove. It is therefore more with the view of establishing the existence of the facts, than of offering any speculations which may arise from them, that these remarks are commenced; and I hope sir, the subject may be sufficiently within your recollection, and means of observation, to permit you to state, in reply, the principal facts and appearances.

"The new and interesting views which this discovery is calculated to suggest in regard to the natural history of stratified rocks, and particularly with reference to the geological age and character of the Mississippi valley, must present themselves in the most clear and striking manner to those who have been particularly accustomed to reflect upon these subjects, and will readily occur to you. We infer the different eras, and deduce the character of secondary rocks, with considerable certainty, from the fossil organized bodies which they disclose in the most solid parts. We perceive from the shells, corallines, and other traces of organic structure which are found, that these rocks were once soft and pliable, so as to be capable of admitting these bodies. We point to the fossil trees, and shrubs, and to the beds of mineral coal having vegetable impressions, as evidences of the destruction of forests, which once flourished upon the older series of rocks. The bones of the mastodon, the horns of elks, and the osseous and undecomposed remains of other large quadrupeds, birds, fish, and

reptiles, which are abundantly found, not only in the alluvial soils, but also occasionally in the rock strata of Europe and America, sufficiently indicate the revolutions and changes which the earth's surface has undergone at comparatively recent periods. We wish only to discover the remains of man, in similar situations, to date these changes subsequent to the Mosaical period of his creation; and here, apparently, we have found them! But the facts demand a careful investigation.

"The drawings which I have taken of these impressions, the inspection of the original, now at Harmony, and the best reflections I have been able to bestow upon attending facts and circumstances, concur in my mind, to establish the conclusion, that they are natural. and genuine; and consequently, that the discovery should be seized upon to erect a new genus of organic remains, of which the specific type should be any portion of the human frame, recognized in the anatomical nomenclature: But it is not conceived to be necessary here, to state the circumstances which induce me to consider these prints as the result of a local submersion of the country extending north of the Grand Tower* on the Mississippi.

"I have the honor to be sir,
With high respect,
Your most obedient servant,
HENRY R. SCHOOLCRAFT."

Col. Benton in Reply.

"*Washington City, April 29th,* 1822.

"Sir,

"Yours of the twenty-seventh was received yesterday. The "prints" of the human feet which you mention. I have seen hundreds of times. They were on the uncovered limestone rock in front of the town of St. Louis. This rock forms the basis of the country, and is deposited in horizontal strata. and in low water is uncovered to the extent of three miles in length on the bank of the Mississippi, and, in some places, from one to two hundred feet wide.

* I am not able to refer to any adequate description of this bold and picturesque feature in the geology of the Mississippi valley. It is cursorily mentioned in my View of the Lead Mines of Missouri. H. R. S.

"The "prints" were seen when the country was first settled, and had the same appearance then as now. No tradition can tell any thing about them. They *look* as old as the rock. They have the same fine polish which the attrition of the sand and water have made upon the rest of the rock which is exposed to their action. I have examined them often with great attention. They are not handsome, but exquisitely natural, both in the form and position, spread-toed, and of course anterior to the use of narrow shoes. I do not think them "impressions," but the work of hands, and refer their existence to the age of the mounds upon the American Bottom, and above the town of St. Louis. My reasons for this opinion are: 1. The hardness of the rock: 2. The want of other tracks leading to and from them: 3. The difficulty of supposing a change so instantaneous and apropos, as must have taken place in the formation of the rock, if impressed when soft enough to receive such deep and distinct tracks. Opposed to this opinion are: 1. The exquisiteness of the workmanship: 2. The difficulty of working in such hard materials without steel or iron.

"A block of 6 or 8 feet long. and 3 or 4 wide, containing the "prints," was cut out by Mr. John Jones, a stone mason in St. Louis, and sold to Mr. Rappe of Indiana, and, under his orders, removed to his establishment, called Harmony, on the left bank of the Wabash.

"Very respectfully yours,

"THOMAS H. BENTON.

"HENRY R. SCHOOLCRAFT."

ART. III.—*An Outline of the Geology of the Highlands, on the River Hudson*—By Prof. AMOS EATON.

SEVERAL sketches of the geology of the Highlands have already been published. The best, which has come to my knowledge, is that of Dr. Akerly, accompanied with a profile view. But Dr. A. told me, that his sketch was drawn up in haste, without a personal examination of the whole succession of strata which constitute this stupendous pile of mountains.

Having been invited to perform some subordinate services at the Military Academy at West Point, a very eligible opportunity was afforded for examining the rock formation in its immediate vicinity. The superintendant, Major Thayer, Dr. L. Foot, Professors Douglass and Cutbush, and myself, crossed the whole breadth of the Highlands, during the month of May last, which is fourteen miles, and continued our examinations so far as to become acquainted with the adjoining rocks on both sides. As the river Hudson crosses this range of mountains from north to south, cutting them down to their very base, each shore of the river presents a very advantageous view of their strata. Accordingly we coasted along each shore in a barge, taking specimens wherever there was the least appearance of any change.

The following is the result of our investigations, given without regard to the order of time in which they were made.

The middle portion of the Highlands for ten miles in extent, taking Buttermilk Falls (two miles below the military academy) for the center, consists almost wholly of well characterized gneiss, with alternating layers of granite. There are also some beds and some alternating layers of hornblende rock, included in it.

These ten miles of gneiss are succeeded, both on the north and south, by hornblende rocks; each about two miles in extent. The true hornblende rocks sometimes alternate with a kind of rock resembling gneiss, in which very dark-coloured lamellar hornblende seems to be substituted for mica. Such are the rocks constituting Butterhill and Dunderbergh.

At the termination of the hornblende rocks, which is the termination of the mountains both north and south, the transition argillite commences. As far as we examined it, we found it alternating with transition (or metalliferous) limestone, and graywacke. The latter contains petrifactions of terebratulites and orthocerites.

We found, that the layers of all the rocks in the range, whether primitive or transition, inclined toward the north-west, from a vertical position. We could find no place whereon to fix, as the middle range, or granitic range, from which to trace a succession of strata on each side, accord-

ing to the Wernerian arrangement. It would rather appear as if the gneiss rocks, ten miles in breadth, were the central or oldest formation ; and that, beginning with this rock, we could trace corresponding strata on each side.

After this *general* view of the rocks constituting the Highlands, a more particular account will be readily comprehended.

The granitic layers embraced in the gneiss consist chiefly of no small proportion of semi-transparent quartz of a hyaline appearance, a very little silver-coloured mica, and a large proportion of greyish-white feldspar of a pearly lustre. In a few limited localities the feldspar is flesh-coloured. Sometimes the quartz is very dark coloured; and in some rocks the feldspar appears of a sky-blue colour.

The mica of the gneiss is almost invariably black, and the feldspar white. Beds of considerable extent are embraced in the gneiss rock near Fort Putnam, which consist chiefly of hornblende. In this rock are found imperfect crystals of green augite of a large size, and considerable quantities of the green coccolite variety.

Where the gneiss meets the hornblende rock stratum, both north and south, many interesting minerals are disseminated. The most beautiful specimens of serpentine in calc spar are found at this meeting of the strata, three miles north of the military academy. They appear like grass-green gems set in masses of pearl.

Vast quantities of very dark lamellar hornblende appear in the form of veins traversing the hornblende rocks. The same variety of hornblende is disseminated in the granitic layers included in the gneiss rocks ; which is often mistaken for shorl on a slight view of the rocks. It sometimes gives the granite a graphic appearance.

Those geologists, who study hand specimens in the cabinet and are disposed to multiply names, may here find the primitive trap, primitive greenstone, sienite, greenstone porphyry ; and perhaps every other variety into which the hornblende rock is varied in any country.

The granulated iron ore containing small crystals of phosphate of lime which abounds in the gneiss rocks of these mountains, together with the carburet of iron, with other minerals, have already been mentioned in former publications. The minerals of these mountains, however, have

not been thoroughly searched out. One object of this essay is, to furnish to the industrious mineralogist those landmarks which an outline of the rocks may afford.

We found no well characterized mica-slate in the Highlands. But the gneiss becomes more slaty about half a mile north of Fort Montgomery, which is four and a half miles south of the Military Academy. It would probably be called mica-slate by some geologists, though it always contains a considerable portion of feldspar. It is highly ferruginous, and tends rapidly to a state of disintegration. It seems to contain considerable soft granulated sulphuret of iron. Similar localities of small extent are found near the Military Academy. Blocks of this variety are laid in the walls of some of the public buildings, which are soon disintegrated; staining the walls before them of a yellow ferruginous hue.

We discovered a vertical layer of a slaty rock set in the gneiss rock, which is, in all respects, similar to gray wacke slate. It is firmly set in the base of the Dunderbergh hill, on the east side of the river. A layer considerably resembling this, though not quite so well characterized, is to be seen among primitive rocks in the adit to Southampton lead mines in Massachusetts. See Index to the Geology of the Northern States, 2d Ed. page 20; and American Journal of Science, Vol I. page 136. Such anomalous formations ought to be attentively studied.

The transition rocks bounding the Highlands on the north and south, bear a strong resemblance to the range of a similar formation along the western foot of the Green Mountains of Vermont and Massachusetts. Maj. Rensselaer Schuyler having transported vast quantities of the metalliferous lime stone rocks from Barnagat, near the north side of the Highlands, for building the great sloop lock in Troy, I had a very favourable opportunity for examining it. It is of a bluish-gray colour, somewhat granulated, and often traversed by veins of white calc spar. It is often cellular, and contains numerous geodes, lined with crystals of quartz. Geologists who travel on the canal, are requested to notice a remarkable circumstance in Schuyler's lock, respecting the meeting of the layers in the rock. They meet and unite by sutures precisely like the bones of the human cra-

nium. The veins of the calc spar are nearly at right angles with the sutures.

It is a remarkable fact that the specific gravity of this rock, (which is 2.86,) the cells, the geodes, the calc spar, crystals, and the quartz crystals, are similar to those of a transition granular quartz rock in Rensselaer county, almost one hundred miles from Barnagat. A fair opportunity for making the comparison will probably remain at Schuyler's lock for ages; as the faced stones are from Barnagat and the back stone from the granular quartz in Rensselaer county.

Most respectfully,

AMOS EATON.

Prof. Benj. Silliman.

Troy, July 3d, 1822.

Art. IV.—*Description and Analysis of a new Ore of Zinc*; by John Torrey, M. D. of New-York. (*From the New-York Medical and Physical Journal for April, May, and June*, 1822.)

[Read before the N. Y. Lyceum of Natural History, April, 1822.]

This mineral was discovered about two years ago, in the town of Ancram, in the state of New-York; a place remarkable for its iron works and lead mine. It was found on taking down one of the old walls of the furnace, erected in the year 1744. It attracted notice from its great weight; and although it resembled some common stone, it was supposed to be an ore, though of what metal was not conjectured. Several specimens having been sent to me for examination, I submitted them to analysis; and the result was altogether different from what the appearance of the mineral indicated. It proved to be a nearly pure oxyd of zinc, and an ore of that metal distinct from any hitherto described. This induced me to make further inquiries respecting the mineral, as it would be exceedingly valuable if found in sufficient quantity; but I have, as yet, been able to procure very little satisfactory information respecting it. Mr. Seth Hunt, who visited Ancram in October last, was informed by Mr. Thomas Ackers, manager of the lead mine, and Rob-

ert Patterson, Esq. of the iron works, that the ore was found *built into* the wall of the furnace, and that notwithstanding the repeated personal search of the latter gentleman, through the surrounding country, for the distance of several miles from the furnace, and making diligent inquiries of the ancient inhabitants, he had not been able to obtain any information that would direct him to the spot from whence it was taken. He has, however, every reason to believe that the ore was obtained within a few miles of the furnace, and, most probably, within a very short distance; but time, through whose lapse it was lost, may again bring it to light, and furnish to the fortunate discoverer, or proprietor, or to both, the means of wealth and independence. Since I received this information from Mr. Hunt, I have heard of the discovery of a considerable quantity of the mineral in the foundation of an old house near Ancram.

Description of the Mineral.

External characters.—All the specimens I have seen were tabular masses, possessing sometimes a distinct slaty structure; though they generally were composed of layers without a tendency to separate, giving the mineral a striped aspect, when viewed in a direction perpendicular to the direction of the strata. (layers ? Ed.)

It is granular and compact.

Its colour is grayish green, or olive green.

It is perfectly opaque and the surface dull.

It is harder than calcareous spar, and is easily reduced to a powder, which is of a lighter green than the mass.

Specific gravity, 4.924.

Chemical characters.—Before the blowpipe it is infusible, but when the heat is intensely urged, the oxyd of zinc is volatalized, communicating a white colour to the flame. The powdered mineral dissolves instantaneously, and almost entirely without effervescence, in the stronger acids.

Analysis.

The following preliminary experiments were made to ascertain the nature of the mineral.

A. Some of it in fine powder was treated with nitric acid. It readily dissolved, leaving only a small quantity of a light black residue. The solution, on being filtered, was transparent and colourless, and yielded quadrangular prisms on evaporation These had a caustic metallic taste, and were very soluble in water and alcohol. When the nitric solution was repeatedly boiled to dryness, and a small quantity of acid added at each operation, some pure oxyd of iron was separated. To the filtered liquor the following tests were applied :—

(*a*) The caustic alkalies produced a white precipitate, which was entirely re-dissolved by an excess of alkali.

(*b*) Prussiate of potash occasioned a white precipitate.

(*c*) Hydro-sulphuret of potash produced the same effect.

(*d*) Copper, iron, and other metallic rods immersed in the solution did not occasion any precipitation of metal.

(*e*) Muriatic acid did not disturb its transparency.

(*f*) Oxalic acid threw down a white precipitate.

B. There remaining no doubt that the principal metal of the ore was zinc, the black insoluble residue was next examined. It was not acted upon by acids, except strong nitric and sulphuric acids, which it appeared to decompose. When made into a ball with a little mucilage, and ignited, it burned almost entirely away without flame or vapour. Projected into melted nitre, it caused a violent deflagration. It was nearly pure *carbon.*

C. One hundred grains of the ore, in fine powder, dissolved immediately in diluted sulphuric acid ; leaving one grain of the black powder, which was ascertained in the preceding experiment to be carbon.

(*a*) The solution was clear and colourless. It afforded flat four-sided prisms on evaporation, having all the properties of sulphate of zinc. These were re-dissolved in water, and carbonate of potash added until precipitation ceased, and the liquor was boiled to ensure the complete decomposition of the metallic salt. The carbonates of zinc and iron were thus obtained.

(*b*) To separate the latter, the whole was re-dissolved in acetic acid, and afterwards boiled to dryness. The acetate of iron was decomposed, leaving the base in a state of per oxyd weighing 3.50 grains.

(*c*) It now remained to determine the quantity of oxyd of zinc, which was done as follows:—The solution obtained in the preceding experiment, after separating the iron, was precipitated by carbonate of potash. The carbonate of zinc thrown down was tested with ammonia, to be certain of the absence of manganese; but this alkali dissolved the whole of the precipitate, and proved it to consist of zinc alone. On evaporoting the ammonia, and calcining the carbonate, 93.50 grains of oxyd of zinc were obtained.

The result of the analysis is:

Oxyd of zinc, -	93.50
Oxyd of iron, -	3.50
Carbon, - -	1.00
	98.00
Loss, - -	2.00
	100.00

The red oxyd of zinc of New-Jersey, discovered by Bruce, resembles our mineral in composition more than any other ore yet described. It however differs essentially in containing 12 per cent. of manganese, and in the absence of iron. Its external characters are altogether dissimilar. To distinguish it from Bruce's mineral, this may be called *green oxyd of zinc*; though I am aware that the name is objectionable, as there is but *one* oxyd of zinc, which is *white*.

It is much to be regretted that a mineral so interesting and valuable should not be better known. We hope the active search which is making for it will not be without success. It is by far the richest ore of zinc known; containing according to Thompson, 75.31 per cent. of metal. The red zinc ore of New-Jersey, beside the manganese which it contains, is always intimately mixed with more than half its weight of Franklinite, from which it is impossible to separate it by mechanical means; while the ore of Ancram is so pure that it can be used without any preparation, either for extracting the metal, or for the manufacture of brass.

Art. V.—*Observations and Geological Remarks on the Minerals of Patterson and the valley of Sparta, in New-Jersey. By* Thomas Nutall, F. L. S. *London.* (*From the New-York Medical and Physical Journal, for April, May, and June*, 1822.)

A cursory geoligical sketch, sufficient to excite a closer attention to the subject in those who follow the same route, may not perhaps be a superfluous introduction to the more immediate subject of the present communication. In my way, by the usual road, to Patterson, along the banks of the Passaic, little presents itself to the observation of the geologist, except the development of the Red sandstone formation, commencing at Bergen heights, four miles west of the city of New-York. In this ridge, which so immediately succeeds that of Hoboken and its *transition* serpentine, (for so I now consider it,) existed the famous copper mine of Mr. Schuyler, now abandoned, and which forms, in fact, only a small portion of a metalliferous bed, extending, at least, as far as the banks of the Rariton.

On approaching the town of Patterson, a scenery more diversified and romantic presents itself, and the surrounding cliffs and precipices, as well as that which produces the picturesqe cataract of this place, consist of beds of trap, well characterized, and reposing on the red sandstone. This formation, which has been so carefully examined by my friend Judge Kinsey, of this place, is peculiarly interesting to the naturalist. The trap contains, as usual in its dispersed cavities, nodules of prehnite, of mezotype, cabasie, stilbite, agates, and, in one locality, fine crystals of datholite or siliceous borate of lime. Sometimes it passes into an amygdaloid, as in the Derbyshire toadstone, from which it can scarcely be distinguished, except by the rarer substances contained. In some of the amygdaloidal cavities lined with crystallized carbonate of lime, occasionally also occur small greenish crystals of the datholite; others are exclusively lined with druses of crystallized or lamellar chlorite, which indeed enters largely into the composition of the wacke or softer trap of this region. In Derbyshire this formation is overlaid by what is called the mountain limestone, one of the more ancient beds of the secondary formation; here the trap

and amygdaloid form the utmost summits of the hills, which in height approach to mountains. Its junction with the *red* sandstone is marked with some peculiar characters, highly imposing to those who feel inclined to favour the Plutonic theory. I must confess that at the point of union in these formations the trap is peculiarly ambiguous: it presents a regular porous structure; not, however, any thing like *pummice;* and many of the pores, if not *all*, seem dependent on the decomposable nature of the carbonate of lime. which still in the interior occupies those supposed pores There are, moreover, in some few places, larger cavities, appearing somewhat glazed; and rugose masses, resembling slags; these are, however, appearances which ought to be weighed with caution, and are insufficient to demonstrate any thing like igneous origin. The porous quartz of Providence township. in Pennsylvania, and of West-Chester, in Delaware, connected with the greenstone formation, is far more imposing as a volcanic production ; yet distinctly traceable into a reticular veined and compact jasper abundantly in place near to the Black Horse Tavern. This porous texture, perfectly original, is such as to render considerable masses of the mineral buoyant on water. But what are we to think of the serpentine, equally porous, in the same locality, and several others, (as near Dixon's farm, Wilmington, where it alternates with graphic granite,) which might be adduced, also gradually and distinctly passing into perfect compactness? If density alone is to be considered conclusive of aqueous origin, we must occasionally introduce a double system of formation into every class of rocks the globe exhibits, nor are even lavas less dense than other rocks, when cooled under considerable pressure.

In the ridge, about two miles west of Paterson, occur very perfect basaltic columns of small magnitude, (about a foot or eighteen inches in length, and from one to four inches in diameter,) presenting from four to six sides; blackish green and crystalline in the interior. This ridge throughout presents inclined beds perpendicularly divisible into columnar concretions as far as the banks of the Little Falls of the Passaic.

This basaltic rock forms the summit of every ridge, for about fifteen miles north-west, to Pompton, where it ceases, and is succeeded by grauwacke, grey, whitish, and liver

brown, containing occasionally pebbles of red and brown jasper. The affinity of this grauwacke with the red sandstone of Patterson is sufficiently obvious, not only from hand specimens, but from identity of relative situation, for they both underlay the trap. Casts of ammonites at Patterson* have been found in the larger pebbles, contiguous with the surface of the red sandstone formation, or near to the point where it *enters into* junction with the porous trap. In the lower portions of this formation, I believe, as yet, no organic remains have been discovered ; and it is not unfrequently, when approaching to a slaty structure and argillaceous consistence, eminently metalliferous, as at Schuyler's copper mine, and that now working at Somerville, which presents masses of the ruby oxid, native copper, and minute portions of native silver.

Contiguous to the western declivity of the Pompton mountains, Judge Kinsey and Doctor Mead found pale green sahlite in abundant masses, connected with a beautiful smallish grained white carbonate of lime or marble, contiguous to a formation of diaphanous greenish yellow perfect serpentine, traversed, like that of Newburyport, with silky seams of amianthus.† Connected apparently with the greenstone formation, is a large rolled or rounded mass of Labrador felspar, sparingly mixed with hornblende, found by Judge Kinsey in the vicinity of the hills of Pompton.

After passing the Pompton mountains, a succession of the ridges of the Highlands present themselves, thickly strewed with rounded *debris,* so as to render even the valley lands difficult to cultivate. Passing the Warwick ridge, or Hamburgh mountains, we enter upon the valley of Sparta, where a white crystalline limestone and marble appear, occupying the valley, and rising westwardly into a low subsidiary ridge, about eight or nine miles in length, proceeding almost due north and south.

As the metalliferous deposites form here the most remarkable feature of the formation, we shall preface our examination of the minerals of Sparta, by a few remarks

* Collected by Judge Kinsey.

† The same mineral, with its usual associate, has been received from Philipstown, on the Hudson, by Professor Renwick, of Columbia College.

upon them. The first, or eastern bed, which at Franklin appears like a black mountain mass, at least thirty or forty feet wide, consists of an ore of iron, in common, scarcely at all magnetic, and with great propriety considered by Berthier as a new metalliferous combination entitled Franklinite, contains 66 per cent. of iron, 16 of zinc, and 17 of the red oxyd of manganese. On the supposed richness of this immense bed, the great furnace of Franklin was built: it was soon, however, discovered not only to be irreducible to metallic iron, but to obstruct the fusion of other better characterized ores in a notable degree. If employed in a quantity exceeding one tenth of the magnetic oxyd of iron with which it was economically mixed, the result was what the miners emphatically termed a *Salamander*, an alloy of iron, with the manganese, which resisted liquifaction, and crystallized even under the blast, so that all the metal was lost, the hearth demolished, and ten or twelve yoke of oxen necessary to drag away the paradoxical and useless metal produced.

This deceptive mineral, now abandoned for want of skill to reduce it, occasionally presents cavities lined with regular octahedral crystals, the sides of whose pyramids to each other as well as the angles of the common base measure by the reflecting goniometer, according to Doctor Torrey, angles of 108.15. At Franklin it is but sparingly intermingled with the red oxyd of zinc. In about two miles to the north, the Franklinite bed ceases to be any longer discoverable at the surface, but continues more or less distinct for five miles further to the southeast, or seven miles in its whole range. Three miles from Franklin furnace, at Stirling, another mountain mass or huge cliff of this formation presents itself; but here the red oxyd of zinc forms, as it were, a paste in which the crystals of Franklinite are thickly imbedded—in fact, a *metalliferous porphyry!* On the sides of the seams, abundance of octahedral crystals of Franklinite are often well developed, while those of the interior are commonly pseudomorphous. Numerous illinitions of the carbonate of zinc appear throughout the interior of the mass. This ore, merely pounded and mixed with copper, has been profitably employed, during the scarcity of the late war, for forming brass.

Often, within a few feet to the west of the Franklinite bed, appear others of well characterized magnetic oxyd of

iron, but always accompanied by hornblende rock. One of the most profitable beds of iron ore was discovered on the very spot where the furnace stands; this highly magnetic oxyd so much esteemed, is very intimately blended with plumbago, so as at first glance to resemble the siderographite of Doctor Torrey. In the latter, however, the iron is perfectly metallic; in this a protoxyd.

Among the more curious accompaniments of this metalliferous formation is the brownish yellow garnet, analyzed by Vanquelin, who found it entirely soluble in muriatic acid, which not only takes up the silex contained, but also the manganese, in consequence of its existing in the mineral at the minimum, of oxydation. The same substance has now also recently been analyzed by Mr. Seybert. It here forms a bed or vein six or more feet wide, and when occasionally in contact with the carbonate of lime exhibits imperfect dodecahedrons of a lustre and colour almost similar to idocrase.

Contiguous to the great bed of Franklinite, at Franklin, is interposed, as it were, in the crystalline carbonate of lime, which prevails to the east, a ledge of imperfect seinitic granite,* scarcely presenting any thing more than gray crystalline rocks of a binary combination of quartz and felspar. In these rocks occur beautiful opaque blackish-brown masses of garnet, of a high resinous lustre, and crystallized on the surface; it agrees in every respect, but the unimportant one of direct colour, with the melanite of Frascati, near Vesuvius; it is accompanied by a laminated epidote almost similar in appearance with the loboïte, or idocrase magnesifere of Berzelius.

Near the same locality there is a vein or two contiguous to the junction of the sienitic granite and carbonate of lime, consisting almost exclusively of a nearly white and compact massive, or minutely lamaller augite, in some parts intimately blended with specks of violet, granular felspar, resembling petrosilex; also sphene, brown garnet, dark green granular augite, like the coccolite of Lake Champlain; something of nearly the same colour, and infusible, which we suppose may prove the Gahnite, occa-

* According to Dr. Maculloch's sagacious definition in his geology of Glen Tilt, being here or there, a mere modification of granite, and totally unconnected with the genuine sienite allied to greenstone.

sionally in octahedrons, and minute pale bluish green prismatic and translucent crystals, which are probably phosphate of lime. These veins, which stand up in crests from the more decomposable carbonate of lime in which they are imbedded, present also on the surface druses of augite crystals, and some of the accompanying minerals.

A little distance from this vein, there is another, apparently much broader in its dimensions, being a mixture in the mass, more or less intimate so as to be often minutely granular, of green felspar of a colour from pale olive to that of carbonate of copper, black hornblende, gray quartz, whitish augite, mica, and occasionally sphene or silico-calcareous oxyd of titanium. In the cavities of this vein, and often considerably immersed below the surface, are, in considerable abundance, bluish green octahedrons of the spinelle, sometimes presenting truncations on the edges, but more commonly on the common base, and occasionally exhibiting cuneiform summits. The angle of coincidence of its faces measured on the reflecting goniometer, by my friend Dr. Torrey, are 109.23; it likewise scratches quartz, is infusible, and scarcely becomes paler by heat. The crystals are in size from the bigness of a pin's head to half an inch in length, the larger of course, darker, and mostly breaking into splintery fragments, have internally a more or less perfectly conchoidal fracture, and high resinous lustre; most of the crystals, when slightly rubbed, indeed, present the brilliance of polished steel; the smaller crystals are also so far translucent as to reflect a splendid coloured reflection, little short of that of the diamond. In these cavities they are commonly associated with augite crystals. quartz, hornblende, green felspar, crystals of phosphate of lime, and in two or three of my specimens imbedded mica, arsenical pyrites, and traces of galena. The affinity which these specimens bear to those of Vesuvius, containing Ceylanite is striking to astonishment, and I have even seen the brucite or condrodite, like that of Sparta, from Vesuvius.* No vestige of volcanic fires, more than the

* In the cabinet of Mr. Wagner, junior, Philadelphia. Since writing the above, my friend Mr. Bowen, subjected another fragment of the supposed condrodite of Vesuvius which belongs to the cabinet at New-Haven, to examination, and found it to agree in the general results, with the analysis of that mineral recently published in Europe. It is now also found in one or two other localities in the United States besides Sparta.

pseudo productions of the Missouri, have yet, however, been discovered in the territories of the United States.

The CONDRODITE, or BRUCITE, almost peculiar to Sparta, discovered likewise by the celebrated Berzelius, in Finland, accompanied by gray Spinelle, is (according to an unpublished analysis which I made in 1820,) a silicate of magnesia with an *accidental* portion of fluoric acid and iron. The same result has been obtained by Dr. Torrey, from whom I copy the following description of its crystallization. It occurs occasionally in small four-sided prisms, (of a paler colour than the amorphous masses,) with rhombic bases of 124° and 56° truncated on the acute lateral edges by planes which form with the contiguous sides of the prism angles of 122° and 114° The prism is terminated by dihedral summits whose faces meet under an obtuse angle, and correspond to the acute, truncated edges of the prism. The edges of the summits are oblique to the axis of the prism, but not parallel to each other; or they may be said to be alternately oblique at each extremity."

Haüy, also, by cleavage, had obtained from it a rhomboidal prism; andBerzelius, who then compared it analytically with his condrodite, concluded it to be identic. The former, with his usual sagacity, referred it to his peridot; as it does not indeed very materially differ in composition from olivin or amorphous chrysolite: still the crystallization proves it to be a very distinct species. It is of a bright brownish yellow, bordering on orange, disseminated in masses commonly about the size of a hazle nut, exhibiting more or less of the rhombic form, throughout a white and foliated lime-stone, generally containing scattered hexagonal laminæ of plumbago, and more rarely, bluish pellucid crystals of phosphate of lime. It is imperfectly lamellar in one direction, splintery in the other, with a glassy or almost resinous lustre, the fragments either translucent or nearly opaque, and sufficiently hard to scratch glass. Before the blowpipe it is infusible, but with borax forms a glass, though not very readily. Its gravity is a small fraction above 3.

Throughout the valley of Sparta the condrodite is by no means uncommon, but variable in its appearance. The finest and clearest masses are obtained at the town of Sparta. Though abundant at Franklin, it is here opaque and of a deeper tinge of colour. It occurs thickly dissemina-

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ted often towards the base of the calcareous beds, and contiguous to foreign infiltrations or veins. A mile south of Franklin furnace it is also seen imbedded in a gray massive augite, accompanied by mica and fluate of lime: the blue fluate here also forms slender illinitions in the marble. Near to this spot tremolite and small imbedded crystals of white augite? and of actynolite occur: short crystals of augite, almost black, like those of volcanic rocks are also now and then visible; a beautiful apple green felspar as indicated by the goniometer, occurs imbedded in the crystalline carbonate of lime, accompanied by perfect crystals of mica, and hexagonal plates of plumbago; this felspar is unusually soft, and almost as fusible as hornblende. A very brilliant pale green hornblende, passing into actynolite is often found massive and in implicated crystalline confused crusts over the surface of the calcareous beds.

This hornblende considerably resembles the *supposed* hypersthene of Delaware, recently analyzed by Mr. Seybert, who considered it as hornblende; it however gives the goniometrical measurement of hornblende, while the Delaware mineral, according to the observation of Dr. Torrey, gives by cleavage, a prism which is nearly rectangular, or with angles of 89° and 91°.

It forms, therefore, a new species, which we propose to name Maclurite, in honour of him who has done so much for American geology, and natural science in general.

According to Mr. Seybert, it contains in the 100 parts: water 1,266; silex 52,166; deutoxide of iron 10,733; manganese a trace; alumine 4; lime 20; magnesia 11,333. From which an obvious affinity to augite presents itself, as it actually differs less in chemical composition from augite, than the two analyses of augite, given in Cleaveland, differ from each other; it fuses also with difficulty; but as the crystalline structure is essentially distinct, it must necessarily be considered as a species destitute of every affinity with hornblende, from which at the same time it is scarcely distinguishable, except by the cleavage. In degree of fusibility, in its hardness, colour, laminar texture, metallic brilliancy, and specific gravity, it is scarcely to be distinguished from the green stone.

In another neighbouring locality, enormous green crystals of augite are found, some at least an inch and a half in diameter, presenting hexaedral or octahedral prisms, with almost equal faces, and terminated by oblique tetrahedral pyramids.

These are accompanied, near the junction of the granite and crystalline carbonate of lime, with large crystals of felspar, scapolite, or wernerite, and something which borders on spodumene. On the margin of the mill pond at the furnace, where some repair was making, a vein of arsenical pyrite, mixed with others resembling the sulphuret of cobalt or nickel, with a substance somewhat like blende, was found, and likewise accompanied by the condrodite.

In another limestone abounding with sphene, dark coloured granules, and minute crystals of augite, there are numerous and generally amorphous, dull grayish blue nodules imbedded, which by goniometrical measurement indicate some variety of fluate. It is nearly quite opaque, but fusible into a white enamel; both externally and internally dull, and minutely splintery or granular in the fracture. It is commonly so much penetrated by the carbonate of lime and titanium oxyd as seldom to present any angle which can be measured. Its hardness is about that of common fluor. It is very feebly acted upon by acids in the cold, but still slowly gives out minute bubbles. When examined it will probably prove the argillaceous fluate of lime, of which I have never seen specimens.

The crystalline calcareous rock, which here alternates with granitines of felspar and quartz, or with beds of sienitic granite, (near to Doctor Fowler's house, the proprietor of the Franklin works,) disappears, and a confluent grauwacke, almost porphyritic, and contemporaneous apparently with the other formations, appears directly overlaid by a bed of leaden minutely granular, *secondary* limestone, containing organic remains of the usual shells and corallines, and layers of blackish hornstone or petrosilex. This rock, as well as the grauwacke *beneath*, presents disseminated crystals of blue fluate of lime. In the limestone the cavities are sometimes very numerous, and lined both with pseudomorphous masses and cubes of blue and white fluate and quartz crystals.

Thus we have here before us, as at lake Champlain, the novel and interesting spectacle of an union of every class of rocks, but *passing* decidedly *into each other* as if almost *contemporaneous!* If they are not contemporaneous, how do they happen to penetrate each other by veins? Why do they present similar mineral substances; similar organic remains; why do the same relicks of plants occur over the

anthracite of Rhode-Island, (which is occasionally penetrated even by seams of asbestus,) as over the bituminous coal-fields of Pittsburg and Richmond? Why are the beds of coal, at Richmond in Virginia, penetrated by *veins* of *granite?*

Lastly, why are the same organic remains found in the *alluvial* limestone of Carolina and Georgia, as those of the Great Calcareous Platform west of the Alleghany mountains?* Are, in fact, those supposed epochas of time, believed to have intervened between the production of strata any thing more than an imaginary distinction of formations really allied, and as strictly dependent on each other, as the members of the same formation? The grauwacke and *red* sand-stone, we perceive, contain organic remains; the grauwacke imperceptibly blends with the granitines, sienites, and greenstones of the Highlands. The hornblende rock and its metalliferous deposites unquestionably pass into gneiss; gneiss is foliated granite. Where then are we to seek for permanent distinctions? What is primitive—what is transition—what secondary—but the alluvions of rivers and of seas? Of what importance is the inclination of strata, as the uppermost must necessarily be inclined at a decreasing angle? Nor are examples wanting of a conformable stratification of the secondary with the oldest or the primitive;† and although the rocks referred to the primitive formation, more frequently present vertical or highly inclined planes of stratification, yet, as Mr. Greenough remarks, it is also true, that every rock in different parts of its course exhibits planes both vertically and horizontally inclined.

I am, I must confess, attached to those plausible distinctions of things which tend so importantly to facilitate information and promote instruction; yet I would not wish to submit to the shackles of an imaginary system, or prostrate understanding at the shrine of an ambitious theory. Nature yet presents a wide field for contemplation; there are mysteries yet unravelled—prejudices which blind—systems which for the present impose, and which must ultimately vanish before the test of truth.

* The pentrenite of Mr. Say, or asterial fossil of Parkinson, is found twelve or fourteen miles from Savannah, in the limestone, as well as in the vicinity of Huntsville in Tennessee.

† See Dr. MacCullock's Mineralogy of the Isle of Sky, Trans. Geolog. Soc. Vol. 3, pp. 50, 51.

‡ Greenough's Geology, p. 40.

Art. VI.—*Notice of Crystallized Steatite—Ores of Iron and Manganese, &c. by* Professor Chester Dewey.

1. *Crystallized Steatite.*

I have lately visited the locality of this mineral. It is found in that great bed of serpentine in Middlefield, county of Hampshire. The rocks about it are all primitive. The crystals of steatite have yet been found only in one place, between two layers of serpentine. The serpentine occurs in immense masses, overlaying each other in strata or blocks separated by seams. Between two of these layers of serpentine is steatite two or three inches thick, the upper surface of which is covered with these crystals. The crystals are however separated from the superabundant mass of serpentine by a thin layer of asbestus. The asbestus is pressed down entirely close upon the crystals, and, if it be carefully removed from them, shows the form of the heads of the crystals. We have only to see the position of the crystals of steatite to be satisfied that they cannot be *pseudomorphous*. This is a strong reason, additional to those given, page 275, Vol. IV. of this Journal, in support of the opinion that they are *true* crystals. There is occasionally found among these crystals, a crystal of oxyd of iron, covered over with the steatite, but of a form entirely different from the crystals of steatite. The appearance of the whole is that when the crystals were formed, the entire mass was in a soft and yielding state. The crystals, which were easy to obtain, have already been removed, and, to obtain more, it will be necessary to remove, in part, the mass of serpentine above them. It is possible that analysis may prove these crystals not to be steatite. That they belong to the steatite family, there can be no doubt; and the genral characters direct to the opinion that they are only a rare and interesting variety of steatite.

2. *Ores of Iron and Manganese in Bennington, Vt.*

The principal bed of the ore lies three miles east of the village of Bennington, very near the furnace at which it is wrought. The ore of manganese is found at the same bed, but entirely separate from the iron ore. The location of

the ore bed is rather singular. It lies at the southern side of a hill, which is connected with a high mountain running in a northerly direction. This mountain has been burnt over until the trees and smaller vegetables for a considerable distance from the summit have been entirely destroyed, and it appears, when viewed from the village of Bennington as a huge mass of white limestone or of quartz. Specimens of the rock were shown me at the furnace. They were magnesian limestone. The hill, which forms the southern part of this mountain, and at whose foot runs a small river, rising in the mountains still farther east, does not exhibit any rock near the mine. The valley on both sides of the river is covered with rounded masses of granular quartz. The bed of ore lies in the side of this hill, in the loose sandy soil or earth which prevails here. Small rounded masses of the quartz are found in the earth over the mine. The bed of iron, where the ore has been dug, is elevated but a few feet above the level of the river. The hill rises pretty rapidly sixty or eighty feet, but the bed of ore does not rise as much, so that at the distance of about thirty or forty feet from the southern part of the bed which has been explored, the iron ore is about fifty feet under the surface of the hill.

The ore of manganese was discovered a little lower down than the iron, and is found to ascend, as the bed is explored, in the same manner as the iron ore. It is always separated from the iron ore by an earthy portion, often very thin, and were there not other distinguishing characters, is not liable to be confounded with the ores of iron.

The bed has been explored for six or eight rods in width, and the iron ore is known to extend along the lower part of the hill and but a foot below the surface, more than twenty rods in width. Its extent up the hill and its depth are unknown; but the ore seems to be inexhaustible. Both kinds of ore are dug with great ease, and a stream of water is turned from the hill into the mine, for the purpose of working the ore. The late proprietor of the ore-bed and furnace, and the proprietor of the manganese, Mr. Trenner, very politely accompanied me in my visit to the place, and afforded me every facility in the examination, while he augmented the pleasure of the visit by his hospitality and readiness to answer all the questions I wished to ask.

The iron ore is the common brown hematite, with some argillaceous oxyd of iron. Yellow ochre is also found in considerable quantity. The ore much resembles that of the mine in Salisbury, Con.; but the stalactitical form is rare here and not so beautiful.

The ore of Manganese is the common black oxyd, generally compact, sometimes mammillary or botryoidal. The excellence of this ore is well known. Many tons are annually carried to market for the purpose of bleaching. The price at Boston varies from forty to fifty dollars a ton. It is also coming into use, as a substitute for red lead, in the glazing of common earthen ware.

One specimen of fluate of lime, crystallized and very beautiful, has been found with the manganese.

Similar iron ore is also found in the north-western part of Bennington. It occurs in beds of one or two inches to six inches in depth, in a loose soil lying upon limestone rocks. Those beds are of small extent, and probably are not connected with any bed like that described above.

It has been remarked that the great bed of ore is not *immediately* connected with any rocks. It seems, however, to be associated with limestone rocks, and the whole to lie between two strata of mica slate. It lies in the same range with the ore of Salisbury, Con. and has the same range of mica slate lying on both sides of it. The same kind of ore is found in scattered pieces on the surface in several of the towns in this County, and in Lenox it occurs in abundance.

Art. VII.—*Notice of a Mineralized Tree—Rocking Stone. &c. by Professor* Jacob Green.

1. *Mineralized Tree, &c. &c.*

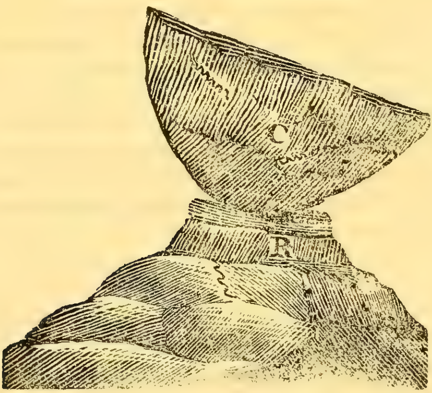
About half a mile from the village of Chitteningo, in Sullivan County, (New-York) a fossil or mineralized tree was some years ago discovered. It lies at the base of the Conasewago mountains, within a few yards of a branch of the Erie canal, which runs up to the village. The tree appears to have been blown down and broken off—there are eight or ten feet of the stump remaining, with some part of the large end near the root—the stump is about three feet

in diameter—the bark—the fibrous texture of the wood and two or three knots are very obvious—there is a substance very much resembling veins disseminated through what seems to have once been the sap vessels of the tree, and from this circumstance, I am induced to believe that it belonged to the Genus Pinus, although others have supposed it a Juglans. The lower part of the root is imbedded in the soil, where it probably once grew. Vast quantities of mineralized wood both in small and large masses are scattered in all directions around this stump—these fragments from their loose porous texture, seem to have been petrified, after the wood began to decay. Indeed so numerous are these fragments that almost every stone in this vicinity appears to have been once a living plant. The traveller who feels interested in mineralogical pursuits, will find Chitteningo well worthy of his attention. Besides the tree just mentioned, hydraulic lime-stone and beautiful lamellar gypsum are found in this neighbourhood; and about two miles from the village, a spring of water, so highly charged with sulphur, that branches of trees, thrown into it, soon becomes incrusted with that mineral.

2. *Rocking Stone.*

Moveable rocks, or masses of stone so nicely balanced as to be set in motion by a very small force, have excited the attention of both ancient and modern writers. As far as my information extends, there is but one of these famous rocks, noticed as being found in the United States—this is in Morse's Geography. When mentioning the curiosities in New-Hampshire, the author makes the following statement: "In the town of Durham, is a rock computed to weigh sixty or seventy tons. It lies so exactly poised on another rock as to be easily moved with one finger. It is on the top of a hill and appears to be natural." Putnam's rock, mentioned in the last number of your Journal, seems also to have been of this description. This rocking stone which I visited last spring, is situated on the farm of Mrs. McCabbe in Phillips Town, Putnam County, New-York. The West-Chester and Dutchess turnpike road, which runs a north east direction from the village of Peekskill to the town of Kent, lies about one mile to the east of this rock. The person who wishes to visit it must travel eight miles

on this road from the village of Peekskill, and then ascend a very high and steep hill on the left hand, near the top of which the rock may be seen. The moveable stone is about thirty-one feet in circumference, and five feet through in the thickest part—it is of granite, the mica bed so stratified as to present somewhat the appearance of gneiss, and it stands or is supported on a base or pedestal of the same mineral. A better idea will be formed of the figure and position of this rock from the rough sketch which accompanies this, than from any verbal description. The under rock or pedestal (R) is about one foot and a half high, and is almost flat on its upper surface. The rolling rock (C) rests on this plane. Although it cannot be shaken as easily as the wonderful rock in Asia mentioned by Pliny—or as the Gygonian stone, which trembled on being "struck with the stalk of an Asphodel;" it can however be rolled a little by the hand, and with a small lever it can be moved with great ease;—notwithstanding this, six men with crow-



bars have been unable to roll it down from its pedestal. Large masses of steatite are scattered around—good specimens of Asbestus, may also be obtained at a short distance. I found some very pretty specimens of blue quartz in the blocks of granite, which form the fence along the road. On the west of the rocking stone, about half a mile, there is a lake three miles long and half a mile wide—a sheet of water of much magnitude is not frequently met with on such an elevation.

3. *Miscellaneous.*

The minerals in the immediate neighbourhood of Princeton, are few, and possess but very little interest. Cubical crystals of iron Pyrites are to be found along the margin of Stony Brook, imbedded in shale. Crystallized quartz, is not uncommon. The crystals are generally imperfect, and not very transparent.

A bed of Argillite, very proper for building stone, crosses the road at the north end of the town—it makes a considerable dip. In this bed, I have been informed that wavellite occurs, but I have in vain searched for it.

Specimens of *recently* petrified wood are sometimes met with lying on the surface. In my cabinet there is a piece, which appears once to have been the lower end of a chesnut post, used for fencing—the exterior of it is black, as though it had been carbonized or charred. I have also seen a mineralized *chip*, with the marks of an axe very apparent upon it—the petrifying matter is silex.

A very excellent bed of siliceous sand, used for mortar, is near the road side, south east of the village. There are other beds of sand in the vicinity. Silex in large pebbles is not uncommon. Yellow earth is found on the side of a hill in our neighbourhood—it is used for painting carriages—and is by artists considered as a *very good* substitute for the tena de Sienna—with Prussian blue it forms a very delicate olive yellow colour.

Art. VIII.—*Miscellaneous Localities of Minerals.*—Editor.

Sulphat of Barytes.—Mores Mills, Berlin, Kensington parish, foliated, pure white, translucent, brittle,—jet and galena imbedded.

Fluor Spar of New-Stratford.—The American Chlorophane, containing imbedded a well defined brilliant crystal of beryl, half an inch in diameter and protruding one inch and a half from the fluor.

Porous decomposed trap filled with numerous white crystals too minute to be distinctly observed, but probably *stilbite.* Talcot Mountain, ten miles west of Hartford.

Iron Pyrites.—Having every appearance of a petrifaction of the body and limbs of a frog. Trumbull County, Ohio.

Fluor Spar.—Black with a resinous lustre, by transmitted light, it appears of a topaz yellow, or like smoky quartz; in the cavities, the crystals are white and transparent. Huron County, Ohio.

Sulphat of Barytes.—White foliated, New-Stratford, Dr. Nathan Smith.

Calcareous Petrifaction of Wood.—Canasarago Creek, New-York. A similar specimen from Chitteningo, a part of a very large tree. Hon. Mr. Storrs, M. C.

Gray Wacke.—With a fine grain, being part of the rock on which Capt. James Cook fell at Owyhee. Mr. Smith of the Cornwallis frigate, Royal Navy of Great-Britain.

Specimens from Prof. F. Hall.

White compact Marble.—Highly translucent, very handsome.

Plumbago, in grey crystallized limestone.

Micaceous Iron, very beautiful, New-Fane.

Magnetic pyrites.—Copperas is made from it at Shrewsbury, Vermont.

Black Tourmalin in Quartz.—Dummerston, very handsome.

Diallage in serpentine Rocks, near New-Haven. This mineral is well characterized.

Galena, near Lexington, Rockbridge County, Virginia. It is in small plates, almost fine grained.

Plumbago.—Cornwall, Conn.—Dr. Cornwell.

From Dr. H. H. Hayden.

Brown tourmalin, nine miles west of Baltimore.

Supposed crystallized Magnesia.

Zeolite—both radiated, (Mesotype) and cubic, (chabasie) near Baltimore.

Ligniform Steatite.—Nine miles from Baltimore.

Shells cemented by the red hæmatite, Winchester, Virginia.

Steatite, coloured of a beautiful lilac (by chrome ?) bare-hills, near Baltimore.

Beautiful ferruginous yellow crystallized quartz,—Blue Edge or South Mountain.

Lamellar Quartz.—Nine miles from Baltimore.

Handsome Porphyry.—Nicholson's Gap, Blue Ridge, Pennsylvania, crystals red and distinct.

Broad foliated Felspar.—Flesh-red, very fine, nine miles from Baltimore.

Brown hæmatite.—Thirteen miles from Baltimore, York Road.

Quartz.—Elegantly stained blue and green, by carbonat of copper, Blue Ridge.

Bitterspath.—Very handsome, forming a vein in the compact limestone, nine miles from Baltimore.

Apatite.—Red crystals in quartz and felspar.

Analcime and Mesotype.

Fine black tourmalin in veins in gneiss.

Elegant brown tourmalins, twenty miles from Baltimore.

Mass of Adularia in crystals with clorite.—Found in a brook near Baltimore, the vein not discovered.

Most beautiful Epidote.—With green and other shades of copper scattered in quartz; the blue is prevalent, abundant in the Blue Ridge.

Quartz and epidote, with green carbonat and red oxid of copper and native copper, Blue Ridge, abundant.

Other Localities.

Petrified Wood, almost black, Stafford County, Virginia.

Arragonite, beautifully crystalized, Bermuda.

Do. in geodes and cavities, forming the cement of a siliceous pudding stone, near Schenectady.—Dr. Murdock.

Iron Sand is found in great quantities on Block-Island, as appears by a M. S. letter of Peter Oliver to Dr. Elliot, Dec. 14, 1761.

Amber was found near the Delaware, in West-Jersy, in detached pieces, near one pound weight, yellowish, nearly transparent, and fitted to make good cane head. Bartram's M. S. letter to Dr. Elliot, Dec. 2, 1762.

Art. IX.—*Descriptive Catalogue of Rocks and Minerals collected in N. Carolina, and forwarded to the American Geological Society, by* Denison Olmsted, M. A.G.S. *Professor of Chemistry, &c. in the College of N. Carolina, April,* 1822.

No. 1. *Sulphate of Barytes*, exhibiting the foliate structure and glistening lustre of the mineral. (handsome.)

2. The same, in mass, of a cubical figure, with quartz on one side. (very handsome.)

3. The same, exhibiting its lustre when so broken as to present the edges of the laminæ distinctly.

These three specimens were obtained at the same place, near Hillsborough, where an abundant formation of the mineral has lately been discovered. It occurs associated with quartz, with which, as in Nos. 1. and 2., it is frequently united in the same mass, the quartz adhering to its sides, and shooting perfect crystals through its mass, as in No. 1. An excavation of only four feet in depth and five or six in length has yet been made; but this has disclosed the Barytes, in cubical and nodular pieces from three to six inches in diameter, lying side by side, and running into crystallized quartz on the right and left. The region around is strewed with fragments of quartz, variously figured, and everywhere shewing a strong tendency towards crystallization, and often actually forming congeries of very regular prisms. Masses of the Barytes of equal purity with No. 2. and six inches in diameter, were taken from the lowest layer, and the size, it was said, regularly increased with the depth. The prevailing rocks of the vicinity are chlorite and clay slates. (very handsome, delicate blue.)

4. *Mica*, from Henry Co. Virginia. The superb lustre and fine shades of colour which this specimen exhibits were common to a great number of pieces brought to me at the same time.

They were furnished by a person who evidently had employed very little pains or skill in selecting the specimens. He reported that those of this kind were exceedingly common. The small piece is added to shew the splendid colours exhibited by refraction from minute veins in a thin lamina. An effulgence of vivid green, blue, and red, displayed at a certain angle, will be particularly observed.

5. *Fine white clay*, from Stokes Co.—An extensive bed of it is said to exist.

6. *Compact carbonate of lime*, of a jetty black. Would not this furnish a marble suitable for pavements?—Found in Tennessee.

7. *Mica Slate*, colour, emerald green, from the western part of this state, (N. Car.) near the Blue Ridge.

8. *An Ore of Manganese*, (black oxid,) from Surry Co.—Reported to exist in great abundance.

9. *Carbonate of Lime*, (grey compact limestone,) from the alluvial country—forms an extensive bed on the lower parts of the Cape Fear, where it is burnt for lime.

10*—14. Varieties of the sandstone, (constituting the independent coal formation?) of this state. (Amer. Journal, Vol. I.) This formation commences not far from the Roanoke, in the county of Person, and passing through the counties of Wake, Orange, Chatham, and Moore, probably terminates at the Yadkin. Its length cannot be less than one hundred miles, and its average breadth not less than from eight to twelve miles. Indications of coal are reported of various places throughout this whole range; and a bed of coal highly bituminous and combustible, has been opened near Deep River, at the southern extremity of the county of Chatham. The pit has been dug only ten feet deep and 20 in diameter. Wagon loads are occasionally carried away by the blacksmiths; but wood and charcoal being very cheap in the vicinity, the coal, although easily obtained, is not much sought for. At the surface of the ground the coal appears only in a stratum of six inches; but at the depth of ten feet it has increased so much as to be two feet thick. Next to the coal is a black, greasy, bituminous shale, of a conchoidal fracture. The remainder of the pit is occupied by clay slate, divided into very thin plates, which fall to pieces when removed.†

The pit being full of water when I visited it, I had no opportunity to ascertain the dip of the strata.

* I am not quite certain whether the sandstone formation terminates on the N. at the Neuse or the Roanoke.

† I regret that I cannot transmit specimens of this coal—I had several pieces, some of which were iridescent, but have used them all in chemical experiments.

This formation affords very numerous varieties of sandstone, (of which those transmitted are but a small part,) including many kinds suitable for building, exhibiting various shades of red, gray and yellow. In several places they are quarried for the purposes of architecture, for grindstones, for whetstones, and, even (when they contain pebbles) for millstones. On its western line the sandstone passes at the foot of the hill on which the college of N. Carolina is built; and fine red and gray sandstone, every way suitable for building, may be obtained within less than two miles of the college.

15. *Sandstone*, of the alluvial country, from Waynesborough. A similar kind is used in Fayetteville for building.

16. *Granite passing into Gneiss*, from Raleigh. This ridge of granite, which extends at least 50 miles, through the counties of Warren, Franklin and Wake, and probably much farther, affords abundant and most excellent materials for building. Lying a little elevated above the neighbouring grounds it is easily quarried; and the universal diffusion of the mica and fineness of the other ingredients give it a looseness of texture which render it capable of being as easily hewn as common sandstone. Its qualities are finely displayed in the late additions to the State House at Raleigh. On the west of Raleigh three miles, it passes decidedly into Gneiss which appears capable of affording the largest slabs; but no quarry of it has yet been opened.

17. *Granite*, from Person Co.—Granites of this description, containing a large share of felspar in a state of decomposition, and affording materials for porcelain clay, are very common in this upper country; and the complexion of the other forms of granite is very various, including coarse and fine-grained, red and grey of various shades, and all degrees of hardness.

18. *Micaceous*, or talcose slate, full of small veins and crystals of pyrites, from Wake. See No. 86.

19. *Talc*, with radiated crystals, from Rockingham.

20. *Indurated Talc*, from Wake, susceptible of a good polish and used for ornamental parts in architecture—both the pieces are, in fact, very fine soap stones.

Talc and soapstone. of various aspects and qualities, appear in every county of the primitive region in this state. I have already ascertained most abundant formations of one or both of these minerals in the counties of Wake, Gran-

ville, Person, Orange, Chatham, Rockingham, Randolph, and Stokes; in all which places, it is employed extensively for various useful purposes in building. Remains of Indian utensils, formed of these substances, are also very common.

21. *Flint*, (Hornstone,) associated with compact earthy limestone, from Wake—occurs in the sandstone formation. Small pieces of carbonate of lime, usually of dark brown colour, are found in various parts of this formation; but no bed has yet been discovered, though it is a great desideratum, lime being transported from Fayettville to this place, 70 miles. Mr. Maclure (Obs. on the Geology of the U. States,) does not encourage us to expect an extensive bed of limestone in the sandstone formation.

22. *Mica slate*, constituting the bed of the plumbago of Wake. This singular rock, which sometimes appears of a cherry red, as in this specimen, and sometimes of a glistening pure white, as in No. 85, and sometimes of the two blended together, lies between the gneiss mentioned under No. 16, on the east, and the sandstone on the west, being covered by the latter on its western declivity. As it appears in the walls of the mine of plumbago, it is seamed horizontally, by which means it is easily obtained in large masses which are used in the neighbouring county for underpinning and steps, though it is evidently too fissile and absorbent to be durable as a building stone. It however, as might be expected, is said to be a most excellent *fire stone*.

23. *Chlorite interspersed with crystals of hornblende*, from Wake.—Occurs in the vicinity of No. 22, and is obtained in sufficient quantity for chimnies.

24. *Marly limestone of Wayne Co.*, in the alluvial country, a little east of the primitive, supposed to be the kind referred to by Mr. Maclure, (Obs. on the Geol. of the U. S. p. 34.)

25. *Primitive granular limestone of Stokes Co.* This county, situated in the north-western part of the state, I have not yet had opportunity to visit; but from the number of specimens sent from there (several of which are among this collection,*) and from their extensive formations of iron, limestone, clay, soapstone, &c. I am induced to believe that it offers an inviting field to the mineralogist. This lime-

* Viz. Nos. 5, 26, 27, 28, 29, 45, 50, 51, 56, 70, 76, 77, 79.

stone usually exhibits some shade of bluish white, (No. 51.) it is sometimes mixed with magnetic pyrites (56); and is frequently traversed by veins of calcareous spar containing fibrous actynolite.(56)

26, 27, 28, and 29. *Chalcedony, Jasper, Agate, Red Jasper, and Yellow Jasper, of Stokes.* These siliceous minerals, including No. 79, and numerous varieties of the same, are found in one field, scattered over the surface of the ground. Pieces of coarse chalcedony, five inches in diameter, were among the number.

30—44. *Varieties of Quartz*, intended to illustrate the following remarks.—A singular deposit of quartz is scattered over this region, covering a tract of country in a narrow band from N. E. to S. W. not less than 50 miles long, passing through the counties of Granville, Orange, and Chatham, and embracing almost every variety of this mineral mentioned in mineralogical works. Indeed, nearly all those in this collection were obtained in one field, six miles west of this village. Besides several other foreign substances, incrusting or penetrating the quartz, fragments similar to No. 41, associated with a large proportion of specular oxide of iron, form a pretty regular line from Hillsborough southward into the county of Chatham, more than twenty miles.

45. *Mica Slate*, from the Saura Town mountains, in Stokes. At the base of the mountain are found heaps of yellow micaceous sand, resembling pyrites, and often deluding the inhabitants with an impression that in contains gold.

46. *Tortuous Mica Slate*, from the western part of S. Carolina.

47—49. *Petrified Woo*—No. 47, is from Fayetteville; 48 from the banks of the Neuse in Wayne Co.; and 49 from the vicinity of this village. In each of these places, it occurs in very numerous fragments, usually scattered over sandy plains. It is highly siliceous, and frequently exhibits veins of chalcedony. No. 49 is found over red sandstone. The banks of the Neuse in many parts of its course are strewed with pieces like No. 48.

50. *Actynolite*, associated with calcareous spar, which traverses the Stokes limestone in veins.

51. *Blue Limestone*, of Stokes.

52. *Sulphuret of Iron*, (capillary pyrites? Jameson 3,210.) From the banks of the Neuse near Waynesborough, found imbedded in an earth that is full of copperas, which effloresces on its surface, and is manufactured by the inhabitants for use. This pyrites also decomposes on the surface of the ground and forms copperas.

53. *Porous Basalt?* from the vicinity of the natural wall [Basaltic Dyke] in Rowan. Is it similar to the Dutch *Terras* (Aikin's Dic. Art. Cement,) and would it answer for hydraulic mortar?

54. *Cubes of Sulphuret of Iron*, exceedingly common in this region. On the Haw River they occur in such abundance that an individual, it is said, supposing them to be valuable, collected several bushels of them. They are frequently striated on the sides, the striæ of two contiguous sides being at right angles.

55. *Epidote* in quartz, found in a small vein crossing clay slate.

56. *Stokes Limestone with Magnetic Pyrites*. When the iron is disseminated through the mass, (as is frequently the case,) would not this lime serve as a water cement?

57. *Pyrites*, same as 52, added to shew their sonorous properties when struck together.

58. Light coloured hornstone in stripes passing into flint.

59. *Native Iron*, fragment of a specimen from Randolph Co. weighing two pounds Avoirdupois. It exhibits the following characters:

Nodular, having one side distinctly plated.
Hard, assuming under the file the lustre of steel.
Highly magnetic.
Specific gravity, 7.4.
Fracture metallic and white like cast steel.
Breaks under the hammer.

It was found in the vicinity of a bed of iron ore, of the argillaceous kind; but no similar piece has been discovered, nor has any effectual search been made for it. Examine for nickel.

60—64. Varieties of Novaculite found in the neighbourhood of this village. No. 60 and 61 are suppossd to be the genuine Whet-Slate of Jameson, or Turkey Oil Stone, described in Rees' Cyclopædia. They are partially faced

and in the condition in which they are employed by the joiners of this country, who prefer them to the finest oil-stones of the market. No. 61 is from a large mass which has been used as an oil-stone by a neighbouring joiner for several years. Having become very smooth by use, it possesses a considerable degree of beauty, presenting a clear ground of olive green, clouded and veined like certain valued marbles. The place where Nos. 60 and 61 were obtained, is seven miles directly west of this village. The slate appears in three sloping parallel ridges, extending north and south to an unknown distance. No. 62 was obtained eighteen miles south of the place which afforded Nos. 60 and 61, but in the same range on the south side of Haw River. It is used there for whetstones, but is suited to coarser instruments than Nos. 60 and 61, and is used with water. It is also employed for grind-stones, for which purpose it is said to be admirable. No. 63 is a coarse specimen of the same. No. 64 another kind used with water.

65 and 66. Slates contiguous to the Novaculite. This county (Orange) is distinguished for Slate, containing, beside those just mentioned, a great variety of Argillite, Clorite, and Greenstone Slates. Some of the argillites near Hillsborough appear to be of the kind called *Alum Slate ;* and the great quantities of pyrites disseminated through many others, indicate materials for Alum and Copperas.

67. *Fine Clay* from a bed in Rowan County.

68. *Petrosilex*, near the Novaculite, six miles west of this village, forming a ridge parallel to that. When first taken from the ground, it may be scratched with a knife, and polished without difficulty ; but it hardens on drying. When polished, the shining black ground, variegated with white specks, renders it quite ornamental. It is extremely abundant, appearing likewise at numerous places in the beds of Haw and Rocky Rivers, (branches of the Cape Fear) and composing a magnificent structure at the Falls of the Yadkin, in the County of Montgomery.

69. The same, from the Falls mentioned in 68.

70. *Tourmalin* crystallized in mass, from Stokes—common in the upper parts of Virginia.

71. *Plumbago* of Wake—best quality slaty.

72. The same of an inferior quality, fibrous.

73. Slaty and fibrous mass, found in detached pieces among the plumbago.

74. Hornstone passing into flint, found in nodules, often four inches in diameter, near this village.

75. *White Marble* from Hagerstown, Maryland, resembling the statuary marble of Vermont.

76—7. *Foliated Talc* from Stokes.

78. *Fibrous Gypsum*, Western part of N. C.

79. *Agate*, from Stokes.

80—7. Specimens designed to illustrate the Plumbago formation of Wake County, viz.

80. Close grained slaty of the best quality.

81. Friable when dug from the pit, but hardens on drying.

82. Same as 80 with a vein of Tremolite. This frequently appears between two contiguous layers of slate, and sometimes in detached pieces as in 73.

83. Rock that forms the bed of the plumbago, taken from the walls.

84. Micaceous Rock that accompanies the Plumbago, same as 83, freed from the Plumbago. This rock has been described in No. 22. It is most commonly red, but sometimes as in the next specimen.

85. White Micaceous rock, associated with Nos. 84 and 87.

86. *Micaceous Sandstone*, occurs on the western side of No. 84, between that and the great sandstone formation, much valued for whetstones and grindstones for softer instruments. No. 18 is a variety of the same.

87. *Yellow Micaceous Rocks*, associated with Nos. 84 and 85.

Of this immense formation of Plumbago,* I propose to furnish a more particular account, and also of a number of other articles comprised in these notes.

* Appearing, as I am credibly informed, fifteen miles from N. to S. and in some places three fourths of a mile in breadth.

Art. X.—*Several other Catalogues of Rocks and Minerals presented to the American Geological Society*

I. From Col. Gibbs.

1. Several magnificent specimens of the Granite of Chesterfield, with its tourmalins, red, green, blue, &c.

2. Do. with its various coloured mica, straw, violet, red, blue, &c. with imbedded tourmalins.

3. Rose coloured mica detached, very beautiful, same locality.

4.* Brucite, crystallized in primitive limestone. Brucite is said now to be the same mineral that is called by Professor Berzelius Chondrodit.

5. Haddam granite, with large crystals of chrysoberyl imbedded—garnet in crystals of great size pervades the mass.

6. Do. with imbedded beryl, 5 inches by 3.

7. Do. do. do. do. distinct and handsome, 4 inches by 1, with tourmalins.

II. From James Pierce, Esq.

8. Gray sandstone, Catskill mountains, the round top exhibits rocks of this character.

9. Dog tooth spar, Schuyler's mine, New-Jersey.

10. Argillaceous schist, found under greenstone, Wehawk, New-Jersey.

11. White graphite in limestone, from the western base of the Highlands, Hamburg, New-Jersey.

12. Sulphate of iron, Morris County, New-Jersey, near Green-pond. At this place copperas was manufactured during the late war.

13. Radiated asbestus, from rocks in place, situated in the primitive district adjacent to New-York—called tremolite by Dr. Bruce.

14. Tubepores, Catskill.

15. Granite, with black mica, from the primitive region four miles from New-York.

* The analysis of this mineral by Mr. Seybert will be found in this Number—it is called by him *Maclurite.*

16. Lenticular crystals of calcareous spar, with quartz crystals, sulphate of lead and iron, Columbia County, near Catskill.

17. New-Jersey pectinites, near Ramapough.

18. Red argillaceous sandstone of this character, stratified, and in nearly horizontal positions, in many parts of the Catskill mountains, alternates with gray sandstone from the base to the summit.*

19. Datholite, calc spar, and green earth, Patterson.

20. A reddish brown graywacke, of this rock, the mural precipices of Raffenberg and Green-pond mountains, Morris County, New-Jersey, are composed.

21. Conglomerate, mostly feldspar and quartz, under greenstone Pallisadoes, New-Jersey.

22. Madrepores, found 60 feet below the surface at Corlaer's Hook, New-York.

23. Granite from a wide and deep vertical vein in granular limestone, Kingsbridge.

24. Chalcedony, Pacquenack mountain, near Pompton plains, New-Jersey.

25. Greenstone, Patterson, New-Jersey.

26. A vein of crystallized Carbonate of magnesia, Staten-Island.

27. Kingsbridge marble, white, crystallized.

28. Toadstone and Patterson Amygdaloid, the carbonate of lime exposed to the air has decayed, giving the specimen a volcanic aspect.

29. Chalcedony and Cacholong, Pracknes mountain, New-Jersey.

30. Serpentine and Amianthus, Hoboken.

31. Ferruginous puddingstone, High-hills of Neversink.

32. Anomias and Terebratulas.—I found this specimen connected with a solid mass on the Catskill mountains, 1500 feet above the Hudson.

33. Catskill encrinites.

34. Feldspar, found in quantity connected with decomposing feldspar and quartz rock, and Kaolin, Weehawk, New-Jersey.

35. Granular limestone, Singsing, Westchester County, New-York.

* Now believed to be varieties of graywacke slate, as observed (June, 1822) by Mr. Pierce and the Editor in a tour over the Catskills; this is understood to be Mr. Eaton's opinion also.

36. Quartz, imbedded in greenstone, with sulphate of iron, Pacquenack mountain, New-Jersey.

37. Madreporite, found fifty feet below the surface in excavating at Corlaer's Hook, New-York.

38. Epidote from a rock of sienite, containing stilbite, West-Chester.

39. Prehnite, Patterson, green mamillary.

40. Marine petrifactions. This specimen is characteristic of the rock composing the nucleus of a mountain range, extending thirty miles, commencing near Esopus, and running two miles west of Catskill.

41. Scaly talc, Staten Island.

42. Stilbite, greenstone range near Scotch plains, New-Jersey; mesotype?

43. Encrinites, Catskill.

44. Native Hidrate of Magnesia, Hoboken.

45. Magnesite, Staten Island.

46. Brucite, Sparta, Sussex County, New-Jersey.

47. Granular limestone, with brown tourmaline, Kingsbridge.

48. Cellular quartz, Staten Island.

49. Friable granular limestone, with a vein of Calc spar, Kingsbridge.

50. Gneiss, near Kingsbridge, much used in New-York.

51. Indurated talc, Staten Island.

52. Oxide of iron and manganese, New-York, three miles from the city.

53. Greenstone, Hudson river.

54. Analcime, Patterson.

55. Steatite, Staten Island.

56. Terebratulas, Catskill.

57. Fine grained greenstone, Weehawk, New-Jersey.

58. Fine sandstone, quarried under greenstone, Pracknes mountain, New-Jersey.

59. Purple and gray sandstone, under greenstone Pallisadoes.

60. Brown Hematite, Staten Island.

61. Greenstone, Palisadoes, New-Jersey.

62. Quartz, with a slight amethystine tinge, and with cuneiform cavities, Patterson.

63. A rock with an argillaceous base, alternating with sandstone, under greenstone Palisadoes.

64. Sandstone of this character is frequently observed as the basis layer at the Palisadoes, New-Jersey.

65. Greenstone, Pracknes mountain, New-Jersey.

66. Quartz with rhombic cavities, that once contained rhombic spar.—Pyritous copper, small crystals of quartz, Fort Lee, New-Jersey.

67. Prhenite, Patterson.

68. Sulphuret of iron, Highlands in Bergen County, New-Jersey.

69. Sulphuret of copper, Schuyler's mine, New-Jersey.

70. Chromate of iron, Staten Island.

71. Galena, Columbia County, near Catskill.

72. Carbonate of copper, with radiating groups of quartz, Patterson.

73. Red oxide of zinc, Sparta, New-Jersey.

74. Granite, Highlands, near Fort Montgomery.

75. Quartz and decomposing felspar, Weehawk, New-Jersey.

III. From Professor Dewey.

76. Gneiss—mica and clay and chlorite and steatitic slate—granular limestone—gray wacke—sand stone—pudding stone—with tourmaline and bitter spath imbedded.

77. White fibrous Tremolite—one mass 21 inches by 9, effervesces.

78. Do. distinctly crystallized—isolated crystals like those of the Alps.

79. Siliceous slate—actinote of Middlefield, handsome.

80. Calc. tufa and marl from Williamstown.

81. Richmond—-stalactical hydrargylite—-bitterspath and green talc—Middlefield.

82. Stalagmite—Sinter Lanesborough cave.

83. Fetid Dolomite.

84. Beautiful green talc Newtown Vermont.

85. Siliceous limestone, Williamstown, 16 per ct. of silex.

86. Chalcedony—Middlefield—partly agatized and well characterized. Very fetid quartz, Williamstown.

87. Molybdena in Actynote, and steatite Middlefield.

88. Staurotide in mica slate, Sheffield.

89. Serpentine Middlefield.

90. Serpentine Middlefield, with Magnetic oxyde of Iron.
90. Whinstone (West Hill)
91. Brown Hematite (Lenox)
92. Talcose slate (West of Williamstown)
93. Schorl in mica slate.
94. Actynolite.
95. Magnetic Iron Sand—great falls thirty-five miles above Glenn's Falls.
96. Oxyd of Manganese—Adams
97. Gibsite (Dr. Torrey) Richmond, Mass.

IV. From Doctor Brown, of Kentucky, through Colonel Gibbs.

98. Petrifactions, siliceous, calcareous, and even in some cases agatized, chiefly of the coral family, entrochi, &c. also sulphate of Barytes with Galena—6 miles north of Nashville, Tenessee; in the channel of a little creek commonly dry. Many of them, however, from the highest lands, from the plantation of Mr. Craighead.

V. From Dr. Alfred Monson.

99. A suite of the Chesterfield minerals—American siliceous spar—tourmalines—sappar, &c. very handsome.

VI. From Messrs. Eaton and Beck.

100. Petrifactions of the Helderburgh.
101. Limestone in argillite Cahoes falls.
102. Gray wacke—Norman's hill.
103. Pentacrinite—terrebratulite, &c. in sandstone in Helderbergh.
104. Schist of the Mowhawk at Niskeuna, full of Pentacrinites—stytastrites—terrebratulites.
Siliceous slate, Bethlehem.
105. Marls, clays, ochres, alum, &c. Helderburgh.
106. Pectinites in schist—Rensellaer county.
107. Green coccolite in bluish crystallized carbonate of lime—very beautiful—Sheene—Essex Co.
108. Encrinite—Marble polished and handsome Coeymans.

109. Handsome crystallized Calcareous spar—Helderburgh.
110. Comallilite, Bern.
111. Bog Iron—Watervliett.
112. Turbinite Helderburgh—Accomite.
113. Gryphite—Trilobite.

VII. From William Maclure,* Esq. President of the Geological Society.

115. Iron. in and with primitive rocks—Philippstadt Iron Mines, Sweden.
116. Many rocks near Clermont—France—St. Julien—Montagne—Lyons, &c. very many granites and other primitive rocks, and granite aggregates.
117. Many volcanic pieces from the Puy de Dome—Clermont and their vicinity—among them are compact and porous lavas with imbedded minerals—some appear to be connecting links between pumice and terrass.
118. Compact and shell limestones and sand stones from Lyons and the Rhone.
119. Primitive rocks and gray wacke from mount Cenis. The highest point of the passage of this mountain is schist with veins of quartz—primitive slates are the prevailing rocks on this mountain.
120. Compact limestone from the Loire and Montbriun.
121. Serpentine from Auginiana where it forms the foot of the hill.
122. Chalk from Aubure where it is covered by a current of lava from the west.
123. Sand stone with vegetable impressions—village of Raynal.
124. Gypsum alternating with schist at Modane.
125. do. graywacke and limestone.

VIII. From Dr. J. Porter, of Plainfield.

126. Mica slate Cummington.
127. Porcelain clay Plainfield.

* Mr. Maclure's specimens amount to nearly 500. In the above catalogues the number occasionally indicates not single specimens, but rather groupes of specimens.

128. Several specimens of rock composed of well defined crystals of black hornblende imbedded in white granular quartz, containing occasionally crystals of garnet and spangles of mica. We scarcely know what to call this aggregate. It forms very beautiful specimens, and looks as if it might have belonged to gneiss.

129. Rock composed of Tremolite, garnet and actynolite crystallized.

120. Black Tourmaline in milky quartz—Hawley.

131. Gneiss rock with hornblende—Plainfield.

132. Irised Quartz—Plainfield.

133. Mica slate—Cummington.

134. Stalactite, (Lanesborough Cave)

135. Rock composed of minute crystals of hornblende interspersed with granular quartz.

136. Chlorite Slate (Cummington)

137. Mica, nearly black, &c. &c.

IX. From Doctor T. D. Porter.

Crystals of the Zircon of Buncomb County, North-Carolina—specimens from this locality are described page 229, Vol. III.—Note.

X. Doctor J. Allen, Brattleborough, Vt.

No. 1. Schorl in Quartz, Brattleborough, Vt. large and fine.
2. Hornblende, New-Fane, Vt.
3. Staurotide in mica slate, Chesterfield, N. H. large crystals.
4. Scaly Talc, New-Fane, Vt.
5. Granite, Hinsdale, N. H.
6. Zoisite, Wardsborough, Vt. very large and distinct crystals.
7. Acicular Actynolite in Talc, Newfane, very handsome.
8. Mica, Hinsdale, N. H.
9. Fibrous Actynolite, Windham, Vt. very good.
10. Granular Quartz, Vernon, Vt.
11. Mica slate, passing into granular Quartz, West River, N. H.—Staurotide.
12. Sienite Newfane, Vt.

13. Hornblende Slate, Brattleborough, Vt. It occurs also at Newfane.
14. Bitter spar, Marlborough.
15. Magnetic Oxide of iron.
16. Dolomite, Jamaica, Vt. in this the magnetic Oxide of Iron occurs.
17. Steatite, Marlborough.
18. Siliceous Limestone, Putney, imbedded in argillite—also at Brattleborough, Vt.
19. Green Fluor Spar, Putney, Vt. this is nearly exhausted.
20. Mica Slate, Jamaica, Vt.
21. Serpentine, Putney, Vt.
22. Green foliated Talc, Windham, Vt.—fine.
23 Roofing Slate, Brattleborough, Vt.
24. Schorl, Hinsdale, N. H.

Art. XI.—*Geological Poems.*

There are few departments of nature which have not been tributary to poetry, as affording either subjects of verse, or figures and images by which it is illustrated and adorned.—Agriculture furnished to the Mantuan bard the rich theme of his Georgics.—Doct. Darwin in our own times has found among plants a fruitful topic of allegorical love.—Some of his satirists have written upon the loves of the Triangles, and the world has been furnished even with piscatory Eclogues.—We believe however that rocks and minerals, and the generalizations and theories of Geology have rarely, if ever, offered any temptations to the muses—for who would think that topics generally regarded as so dry and repulsive, are capable of being clothed in a form susceptible at once of poetical embellishment, and of didactic instruction.—These remarks have been caused by the perusal of some poems written at Oxford, and published in London in 1820, which are certainly curiosities both in literature and science—as they are almost entirely unknown in this country, and are at once specimens of skilful poetry, and of a lucid exhibition of geological facts and doctrines—we have thought that the republication of some of them would not be inconsistent with the gravity of this work, and

would probably prove both instructive and amusing to our readers. We have rarely seen in any form a more condensed exhibition of the principal facts and doctrines of the Wernerian Geology, than are contained in the POETICAL GEOGNOSY, which, with the GRANITOGONY and the GEOLOGICAL COOKERY, we now republish with all their appendages of preface, arguments and notes.—A very few passages indicate in the poet an imagination perhaps rather too warm, but we have not thought it worth while to maim the verse by dissecting them out.

A POETICAL GEOGNOSY.

PREFACE.

The external part or crust of the globe, wherever it has been extensively examined, is composed of different rocks, generally arranged in beds or layers over each other; and these beds appear to have been consolidated at different epochs. Many of the beds contain remains of extinct genera or species of animals; and certain species are often peculiar to certain beds, above or below which they are never observed. Now it is evident that the animals whose remains are imbedded in the lower rocks, could not have been cotemporaneous with those found in the upper, by which they are covered: hence the different ages of these rocks are proved.

The lowest rocks that we are acquainted with contain few or no remains of organic life; but from their position it is inferred that they have been formed at different periods: the lowest are supposed, with certain limitations, to be the oldest. It is also well deserving attention, that the animal remains in the lower rocks belong exclusively to the simplest forms of organic life; namely, to moluscous animals and zoophytes; and that the remains of vertebrated animals, or such as possessed a brain and spinal marrow, never occur in or below the regular coal strata.*

* This position has been recently objected to; but the author is of opinion that its truth has not yet been invalidated. He is also fully convinced that all the writers who have hitherto attempted to apply Werner's arrange-

It has been further observed that in the order in which rocks are placed over each other, there is an approximation to a regular succession in every part of the globe, with the exception of certain rocks supposed like the volcanic to be formed by subterranean fire, and which cover other rocks without any regular order. Though the whole series of rock formations enumerated at p. 6, may never have been observed together in any one situation, yet wherever they do occur, the rocks placed at the top of the series, are never found under any of the others. Chalk, or green sand, sometimes rests immediately on lias limestone, or red sandstone, without the intervention of the oolites, but we never find the oolites above chalk. Some of the rock formations do not extend to every part of the globe: thus chalk and oolite are not found in Wales or the north-west part of England; and, according to Humboldt, they are entirely wanting over a great part of South America. It still remains true, that wherever different formations are observed over each other, there is an approximation to a regular order of succession :—to trace this succession is the most important part of the science denominated Geology.

The author thought it might be useful to describe the order of succession of the principal rocks, in an amusing form, divested of all unnecessary technicality, that the subject might be the more easily understood and remembered. This is the utmost merit to which the Poetical Geognosy lays claim.

The Geological Cookery is intended to impress on the memory of the student the structure of aggregated rocks.

London, January 22, 1820.

ment to the Geology of England, have made the most important mistakes: mistakes which have introduced much confusion, and prevented the Geologists on the Continent from understanding the description given of the geology o this country. He trusts he shall make this apparent in a work he is preparing for publication.

A

POETICAL GEOGNOSY;

OR

FEASTING AND FIGHTING.

Ter Neptunus aquis cum torvo brachia vultu
Exserere ausus erat: ter non tulit aeris æstus.
OVID. Met. lib. 2.

THE ARGUMENT.

The Poem commenceth with the beginning of things: the scene of the action is laid under the ocean; and the Poet proceedeth to describe the order of succession of the various rocks. Their frequent dislocations are hinted at (line 7.)—Granite is first seated at the bottom: Gneiss and Mica-slate are seated next to Granite; the distortions of Gneiss, and its frequent intermixture with Mica-slate (line 14 to 19).—The series of Slate-rocks follow, intermixed with the Lower Limestones (line 22).—The origin of Limestone from the oxidation of calcium (line 26).—Porphyry, Eurite, Greenstone, and Sienite, occur without any regular order of succession; they often lie unconformably over other rocks, and are supposed by some geologists to be the products of fire (line 32—45).—Serpentine often connected with Mica-slate (line 51).—Character of Grauwaccé (line 55).—Great Limestone filled with remains of encrinites (*entrochi*) contains large caverns (line 60).—Series of Coal strata (line 62).—The Red Sandstone or Red Marle which covers Coal strata contains Rock-salt and Gypsum (line 69);—it lies under Lias Limestone, and sometimes incloses Magnesian Limestone (line 73).—The Oolites and various strata with which they are associated are seated above Lias Limestone (line 75).—Chalk and Chalk-marle spread along the coast in many parts of England and France; they are therefore seated close to Neptune (line 78).—Partial formations of strata, deposited after the Chalk, in detached lakes (line 81).—Gravel and black Earth near the sides of rivers contain the teeth and bones of the mammoth and other extinct species of large mammalia (line 80—85),—Strata round Paris; the lowest bed, the *Calcaire Grossier*, is filled with Cerites, and the Marle above it with Lymnites (line 86—91).—An enumeration of the most remarkable fossil organic remains (line 94).—Oviparous vertebrated animals, such as lizards and fish, occur plentifully in Lias Limestone, and the latter sometimes in Magnesian Limestone (line 105).—Coal strata contain almost exclusively remains of vegetables (line 110).—The Great Limestone filled with Encrinites (line 112).—Organic remains more rare in the Lower Limestones (line 113; occur occasionally in Slate (line 115).—White Statua-

ry Marble and the lower rocks contain no organic remains, but are the repositories of metallic ores and various precious minerals (line 124—134).—The Poet now proceedeth to relate the changes produced on the crust of the globe by the agency of Pluto or subterranean fire.—Basaltic rocks frequently crystallized in columnar ranges, during their consolidation (line 147).—Greenstone and Eurite are described as beginning to run or melt (line 151).—Dark lavas and basalts appeared to have been formed of the former, and whiter Lavas and Clink-stones of the latter—Porphyry is with much reason believed in many instances to have been liquified by fire.—In Auvergne and other districts there are porphyritic rocks which appear to have been softened by heat, and again consolidated in their original position, or *in situ*, without ever having flowed as lava (line 156).—The Poet referreth to the conflict of the two contending elements when these great changes were taking place, and then his muse desireth him to conclude.

GEOLOGICAL ORDER OF SUCCESSION.

Alluvial soil and gravel.
Partial series of Strata over chalk.

Chalk and Chalk Marle. Red and Green Sand. Various Oolites, &c. Lias Limestone and Clay.	*The following rocks frequently occur without any regular order of succession.*
Red Marle or Sandstone with Gypsum, Rock-salt and Magnesian Limestone. Sandstone, Shale, and Coal. Great Limestone.	Basalt Lava.
Sandstone, Coarse Slate, and Grauwaccé, Various Slate-rocks, containing beds of Lower Limestone. Mica-slate, sometimes with white Limestone and Serpentine. Gneiss. Granite.	Porphyry, Eurite, Sienite, Greenstone or Hornblende rock, Serpentine.

A POETICAL GEOGNOSY.

When Nature was young, and Earth in her prime,
All the Rocks were invited with Neptune to dine.
On his green bed of state he was gracefully seated,
And each as they enter'd was civilly greeted.
But in choosing their seats, some confusion arose,
Much jostling and scrambling, and treading on toes ;
Till with some dislocations, and many *wry faces*,
They at length became quiet, and kept their own places.
Reveal, heavenly Muse, for I know thou art able,
How each guest in succession was ranged at the table ;
How the dinner was served, and the name of each dish,
Whether Nautilite, Ammonite, tortoise, or fish.

First Granite[1] sat down, and then beckon'd his queen,
But Gneiss[2] stepp'd in rudely, and elbow'd between,
Pushing Mica-slate[3] further ; when she with a frown
Cried, " You crusty, distorted, and hump-back'd old clown !"
But this was all sham,—for to tell you the truth,
They had been the most intimate friends from her youth.
But let scandal cease. See the whole tribe of Slates
All eager and ready to rush to their plates ;
Oh heav'ns ! how the family pour in by dozens,
Of brothers, and sisters, and nephews, and cousins[4] !
The elder-born Limestones ran in between these,—
They were very well known to be fond of a squeeze.
Now, before we proceed with our story, it meet is
That we hint at th' amours of Calcium and Thetis :
But the tale shall be short. 'Tis agreed by the sages,
Hence sprang all the limestones of different ages :
The oldest look'd white[5] ; and no wonder she should,
She had never once dined upon animal food.

1 See Granitogony and Geological Cookery.

2 Gneiss.—This rock is composed of the same minerals as Granite, but it has a slaty structure ; its beds are often much distorted, and intermixed with Mica-slate.

3 Mica-slate.—A shining shistose rock, composed principally of Mica and Quartz.

4 Among Slate Rocks we may enumerate, as the principal, Clay-slate, of which Roofing-slate is a variety ; Talc-slate, or Chlorite-slate ; Hornblende-slate ; Flinty-slate ; Drawing-slate : Whetstone-slate ; Porphyritic-slate ; and Alum-slate.

5 The oldest Limestone, or White Statuary Marble, contains no remains whatever of marine or other animals.

Ere these Rocks were all seated, the loud sounding call
Of " Our places ! Our places !" rang shrill through the hall.
On hearing the noise, the Muse turn'd round her head,
And saw Porphyry[6] and Eurite—their faces were red.
Then Greenstone[7] and Sienite[8] follow'd behind,—
Their seats were bespoke (they said) time out of mind.
Great Neptune rose up, and then swore in a rage
That each rock should be seated according to age;
" But let those (where the register cannot be found
Either under the water or on the dry ground)
Not presume to take regular seats at the table,
But change places with others, whenever they 're able."
Thus the last-mentioned rocks were obliged to retire,
Though their ages were book'd in the office of fire :
(This they said,) but no soul would go there to inquire.
Leaning over old Gneiss and the Slate-rocks they stood,
Or else press'd between them, whenever they could.
Gay Serpentine[9], clad in a livery of green,
At Mica-slate's feet during dinner was seen ;
Among the first class it was publicly said,
He had often been found fast asleep in her bed.
When these rocks were thus settled, and quiet restored,
The others more orderly march'd to the board.
Say, Muse, who is he that is just walking in ?
O ! his name is as harsh and as rough as his skin,
He's a cousin of Slate, but he looks wild and cracky,
And is known as the far-famed illustrious Grau-Waccé.[10]
Younger Slate-rocks, with Sand-stone, then came side by side,
And he, the Great Limestone, of limestones the pride,
Who has caves with wild echos resounding and vocal,
And is called by the masons *grey marble entrochal.*
The next were a grave-looking set on the whole,
Who came in a group to accompany Coal.
Coarse grit-stones, with sand-stones, and clay-binds, and shale.
Some were hard, some were soft, some were dingy, some pale;

6 For the composition of Porphyry see Geolcgical Cookery.—Eurite ; see Primer.

7 Greenstone ; see Diabase, Primer.

8 Sienite.—A rock similar to Granite, but containing a mixture of a dark mineral called Hornblende.

9 Serpentine, the prevailing colour of this rock is green. It often occurs imbedded in Mica-slate.

10 Slate appears to pass by gradation into coarse grit stone, by the mixture and increase of Quartzy or sandy particles, and is then called Grau-Waccé. The French Geologists class Grau-Waccé and many of the Sandstones together, under the name of Psammite, and more recently under that of Thaumite. These terms are no improvement either in sense or sound.

They oft proved deceitful when thought very sound,
For they had many *faults*[11], which they hid under ground.
Red Sand-stone came after, and licking his lips,
He brought in the salt, on a salver of Gyps.
To two sister limestones he had a strong bias,
The one was Magnesian[12], the other was Lias.
Though the former look'd sallow, he press'd the dear charmer
So close, his attentions did sometimes alarm her:
But Lias was *flat*, and seem'd sombre and dull,
For with shell-fish and lizards her stomach was full.
Then Oolites[13], with sandstones, and sand red and green
In a crowd, near the top of the table were seen.
The last that were seated were Chalk-marl and Chalk,
They were placed close to Neptune, to keep him in talk.
Now the God gave his orders, "If more guests should come,
Let them dine with the Lakes, in a separate room."
As for Gravels, and Black-earth, and other gross livers,
They may feast out of doors, by the side of the rivers.
Kill Aurochs[14] and Mammoths, not heeding their groans,
But let them take care of the teeth and the bones."
The Strata from Paris arrived very late,
With letters, requesting a chair and a plate.
"*Eh bien*," said the God, with a good natured air,
"*Faites entrer Monsieur le Calcaire Grossier;*
Let him and his friends at a sideboard be placed,
And with Cerites[15] and Lymnites the covers be graced."
Now, Muse, raise thy voice, and be kind to our wishes,
And tell us the names of the principal dishes.
To Chalk, preserved palates and fossil Echini
Were handed in Cham-shells more pearly than China.

11 Faults or dislocations—frequent in coal strata, and occasion much inconvenience to miners.

12 Magnesian Limestone, and Lias Limestone.—Magnesian Limestone, generally of a yellow colour, sometimes contains remains of fish. Lias Limestone occurs in flat and nearly horizontal strata, some of which abound with remains of oviparous quadrupeds, Lizards of enormous size, together with remains of scaly fish, Ammonites, Gryphites, and Pentacrinites.

13 Oolite, or Roe-stone.—Portland stone, Bath stone, and Rotten stone, are Oolites, or Roe-stones.

14 Aurochs and Mammoths. Auroch a species of ox, whose bones are found in gravel and alluvial soil. Mammoth, the fossil elephant;—the teeth and bones are frequently found in gravel and alluvial soil in England, and are very common in Siberia.

15 Cerites.—Fossil shells in the strata of Paris. The Lymnites are a species of fresh-water snail.

Then Alcyonites[16], Nautilites[17], graced a tureen,
With Belemnites tastefully stuck in between.
The Oolites were served with a wondrous profusion
Of Bivalves, dished up in apparent confusion.
There Trigonias[18], Anomias, and Arcas were placed,
And each rock took the species that tickled his taste.
At this juncture some Limpets[19] were sent in on one dish,
From our worthy friend Halifax, vicar of Standish.
Now oviparous creatures, in which the back-bone is[20],
Were hash'd with remains of the Cornua Ammonis.
They were bringing in more; but great Neptune cried "Halt!
Place no vertebral animal lower than Salt[21]:
Those grits, and those shales, hold inflammable matter,
Let no lizards or fishes e'er smoke on their platter:
Give them fern-leaves, and palm-stalks, and such like spare diet,
And Coal and Pyrites will keep very quiet.
The Great Limestone full plates of Encrini will want,
To some of the others a few you may grant:
Feed the lower with Coral; and some of the Slates
May have Shell-fish most sparingly spread on their plates.
The eldest born Limestone, whose colour so white is,
Of Mica and Talc-slate the well known delight is;
With Granite and all the old Rocks she shall fare,
And dine on bright Crystals, both costly and rare."
The commands of great Neptune were duly observed,
And their dinner in state was most splendidly served.
Yellow Topaz, red Garnets, and Emeralds, we're told,
Were sent under covers of bright burnish'd gold,
With Schorl's red and green, and blue Sapphires and Beryl;
But the Muse thought this diet too arid and steril,

16 Alcyonite. A fossil Zoophite, somewhat resembling a fungus.

17 Nautilite, the fossil Nautilus. Belemnite:—This well-known fossil, vulgarly called thunder-bolt, is frequently about the length and thickness of the finger, but is pointed at the lower extremity. It is classed by Lamarck with univalve shells, having many cells, like the Nautilus. It has been sometimes called the straight Nautilus. The genus is extinct.

18 Trigonias, &c. Some of the genera of Bivalves, common in many limestone strata.

19 Limpets. This fossil is extremely rare. It is found in the Oolite formation, in some quarries near Stroude in Gloucestershire. Specimens of it were presented to the author by the Rev. R. H.

20 Lizards and scaly fish.

21 Lower than Salt. The author is decidedly of opinion, that all the accounts of remains of vertebrated animals found in strata below the red Marle, or Sandstone, containing salt or gypsum, are erroneous, and have originated in a mistake respecting the true Geological position of the strata. Fresh water muscles occur rarely in some of the coal-shales of Yorkshire and Derbyshire, and also in Flanders.

So she moved from the seat of such infinite splendour;
For, like us, she loved something more juicy and tender.
Long lasted the dinner—No rock from his seat
Ever moved, or evinced the least wish to retreat;
And old Neptune found out, as the wise ones aver,
When the rocks are once seated, they love not to stir.
So he rose unobserved, and began to retire;
But 'tis whisper'd the Sea-God already smelt fire.
Be this as it may—a deep hollow sound,
Still nearer and nearer was heard under ground;
'Twas the chariot of Pluto,—in whirlwinds of flame
Through a rent in the earth to the dinner he came.
"Oh, by Styx and by Hecate, my rage I wont smother,
What—Nep give a feast, without asking his brother?
Though I am King of Hell—what, am I such a sinner
That I can't be invited to smoke after dinner?
Let Nep with his waves and his waters all go to—
I'll make the rocks dance, or my name is not Pluto."
Thrice he stamp'd in a rage, and with crashes like thunder
The earth open'd wide, and the rocks burst asunder,
And the red streaming lava flow'd over and under.
It spread far and wide, till grim Pluto said "Halt!"
And ranged it in columns and files of Basalt!
For he saw Neptune coming, collecting his might,
And roaring and raising his waves for the fight.
  Now were Eurite[22] and greenstone beginning to *run*[23],
Which Hutton and Hall[24] said was excellent fun.
But a rock-rending scene in the sequel it proved,
E'en the hard heart of Porphyry was melted and moved.
And many a rock the muse could not draw nigh to,
She saw very plainly was soften'd *in situ.*
Now thick vapours of Sulphur and clouds black as night,
Roll'd in volumes, and hid the whole scene from the sight;
And the Muse told the Poet 'twas time to take flight:
Adding this—"My good fellow, pray leave off your writing,
We have had quite enough both of feasting and fighting."

22 For Eurite see note p. 22. Compact Eurites have been classed by geologists under the indefinite and frequently misapplied denominations of Compact Felspar. The lavas which melt into a black glass are formed from Greenstone, principally composed of Augit and Felspar, and those which melt into a white glass of Eurite, in which Felspar is the predominating ingredient.

23 Run or melt. Alluding to the fusibility of these rocks.

24 Dr. Hutton and Sir James Hall, the well known supporters of the theory which ascribes the formation of these rocks to the agency of heat. The latter has supported his opinions by a series of the most interesting and satisfactory experiments. See Transactions of the Royal Society of Edinburgh.

GRANITOGONY,

OR

THE BIRTH OF GRANITE.

The Granitogony was written in 1811, when the author was on a visit at Derby, the former residence of Dr. Darwin. In the company of a few scientific friends it was suggested, that, if the Doctor had lived to see the progress of Geology, he would have favoured the world with another poem, "The Loves of the Mountains." Impressed with this idea, the author, on the following day, to amuse a long and solitary walk in December, composed the annexed verses, *studio minuente laborem.* They were written and shown on his return, and the Moral was afterwards added. The reason for the present publication is given in the Preface. At the period when this poem was composed, the author was more disposed to adopt the theory of those philosophers who assert that the world has been baked, than that of the German Geogonists, who assert that it has only been boiled. He now inclines to a midway faith; and is disposed to believe that the crust of our planet has been stewed, fire and water being equally operative in its formation.

In ancient time, ere Granite[1] first had birth,
And form'd the solid pavement of the earth,
Stern Silex[2] reign'd, and felt the strong desire
To have a son, the semblance of the sire.
To soft Alumina[3] his court he paid,
But tried in vain to win the gentle maid;
Till to caloric and the spirits of flame
He sued for aid—nor sued for aid in vain:
They warm'd her heart, the bridal couch they spread,
And Felspar[4] was the offspring of their bed:

1 Granite.—This rock is essentially composed of three minerals, Quartz, Felspar, and Mica united, without any cement, or without interstices between them; frequently the three minerals appear to penetrate each other. Hence it has been supposed that these minerals were crystallized and united when the mass was in a state of fusion.

2 Silex.—This earth is one of the principal constituent elements of the three minerals that form Granite. Quartz is nearly pure Silex; it is more imperishable than Felspar or Mica.

3 Alumina.—This earth is soft and unctuous when moist. It is a constituent part of Felspar, in which it is combined with a large portion of Silex, and with other ingredients. As Silex and Alumina cannot be made to combine chemically by water, the Muse has properly sought aid from caloric to promote their union.

4 Felspar, when crystalline, is distinguished by its laminar structure and smooth shining face.

He on his sparkling front and polished face
Mix'd with his father's strength his mother's grace.
Young Felspar flourish'd, and in early life
With pale Magnesia lived like man and wife.
From this soft union sprang a sprightly dame,
Sparkling with life—and Mica[5] was her name.
Then Silex, Felspar, Mica, dwelt alone,
The triple deities on Terra's throne.
For he, stern Silex, all access denied
To other gods, or other powers beside[6].
Oft when gay Flora and Pomona strove
To land their stores, their bark he rudely drove
Far from his coast ; and in his wrath he swore
They ne'er should land them on his flinty shore.
Fired at this harsh refusal, angry Jove,
In terrors clad, descended from above ;
His glory and his vengeance he enshrouds,
Involved in tempests and a night of clouds :
O'er Mica's head the livid lightning play'd,
And peals of thunder scared the astonished maid.
To seek her much-loved parents quick she flew ;
Her arms elastic round their necks she threw,—
"Thus may I perish, never more to part,
Press'd to my much lov'd sire's and grand-sire's heart!"
So spoke the maid. The thunder-bolt had fled,
And all were number'd with the silent dead.
But, interfused and changed to stone, they rise
A mass of Granite[7] towering to the skies.
O'er the whole globe this ponderous mass extends,
Round either pole its might arms it bends ;
And thus was doom'd to bear in after time
All other rocks of every class and clime.
So sings the bard that Granite first had birth,
And form'd the solid pavement of the earth :
And minor bards may sing, whene'er they list,
Of Argillaceous or Micaceous Schist.

5 Mica.—The descent of mica may be rather dubious : the quantity of Magnesia which enters into the composition of this mineral, as given in some analyses, is very small.

6 Siliceous earth alone is extremely unfavourable to vegetation, and granitic rocks, in which this earth abounds, remain for ages denuded and barren.

7 Granite forms the summits and peaks of lofty mountains. It is also supposed by geologists to be the lowest rock with which we are acquainted, forming a foundation for other rocks in every part of the globe.

MORAL[8].

Learn hence, ye flinty hearted rocks,
Your burthens all to bear,
Lest Jove should fix you in the stocks,
Or toss you in the air.

GEOLOGICAL COOKERY.

To make Granite.

Of Felspar and Quartz a large quantity take,
Then pepper with Mica, and mix up and bake.
This Granite for common occasions is good;
But, on Saint-days and Sundays, be it understood,
If with bishops and lords in the state room you dine,
Then sprinkle with Topaz, or else Tourmaline.

N. B. The proportion of the ingredients may be varied *ad libitum;*—it will keep a long time.

To make Porphyry.

Let Silex and Argil be well kneaded down,
Then colour at pleasure, red, grey, green, or brown:
When the paste is all ready, stick in here and there
Small crystals of Felspar, both oblong and square[1].

To make Pudding-stone.

To vary your dishes, and shun any waste,
Should you have any left of the very same paste,
You may make a plum-pudding; but then do not stint
The quantum of Pebbles—Chert, Jasper, or Flint.

8 MORAL. The friend to whom this poem was first shown in 1811, suggested the propriety of annexing a Moral. In compliance with general custom, he followed the advice. It would, however have been more consonant to his own modesty, to have left the moral application to the reader's sagacity, than to have thus obtruded it on his notice.

1 This is the old-fashioned receipt for making Porphyry, used by our grandmothers: viz. they made the paste first, and stuck in the Felspar afterwards. This method is easy and plain: but in the most approved modern receipts, the ingredients are all mixed together at first, and the felspar is left to crystallize while the paste is hardening.

To make Amygdaloid.

Take a mountain of Wacke[2], somewhat softish and green,
In which bladder-shaped holes may be every where seen;
Choose a part where these holes are decidedly void all,
Pour Silex in these, to form Agates spheroidal,
And the mass in a trice will be Amygdaloidal.

To make a good Breccia with a Calcareous Cement.

Break your rocks in sharp fragments, preserving the angles;
Of Mica or Quartz you may add a few spangles:
Then let your white batter be well filtered through,
Till the parts stick as firm as if fastened by glue.

To make a coarser Breccia.

For a Breccia more coarse you may vary your matter;
Pound Clay, Quartz, and Iron-stone, moisten'd with water:
Pour these on your fragments, and then wait awhile,
Till the Oxyd of Iron is red as a tile[3].

2 Wacke. See Primer, p. 24. Wacke is generally greenish, and rather unctuous to the touch. This rock must not be confounded with Grey-Waccé.

3 The geological Neophyte who attempts to make aggregated rocks from the above approved receipts, should attend to the following directions:—Granite rocks must be composed of crystalline grains of two or more different species of minerals closely united without any cement—Porphyry, of a base or paste containing imbedded crystals (generally of felspar)—Pudding-stone, of rounded stones plentifully imbedded in a siliceous paste—Amygdaloid, of basalt or wacke inclosing nodules of agate or chalcedony—Breccia, of angular fragments of any kind of rock, united by a cement. When large rounded pieces mixed with fragments are held together by a cement, it is generally called a coarse conglomerate.

BOTANY.

Art. XII.—*A Catalogue of a collection of Plants made in East-Florida, during the months of October and November*, 1821. *By A. Ware, Esq.*—*By* Thos. Nuttall.

The very imperfect knowledge which we yet possess of the vegetable productions of Florida, and more particularly that part of it now recently ceded to the United States, renders any additional information acceptable, however incomplete. The first enterprising naturalist who visited this delightfully temperate region, was our venerable friend Mr. William Bartram, of Kingsessing, but unfortunately for science, his collections have been consigned to oblivion, though still, I believe, existing in the Banksian herbarium. Doctor Fothergill, his patron, being rather an amateur than a successful cultivator of natural science, never brought forward the result of Mr. Bartram's labours.

The next scientific traveller who visited Florida, was the indefatigable André Michaux, who did indeed describe a few of the peculiar plants of this country; his account, however, is extremely limited, and many of the most remarkable productions mentioned by Bartram are unaccountably overlooked or neglected.

The interesting fasciculus now collected by Mr. Ware, though made at an unfavourable season of the year, indicates the existence of a rich and varied Flora, and of a climate almost congenial to the cultivation of every important commercial production of the tropics.

We have given the collection as we found it, and enumerated those plants which are common as well as those which are new or rare, considering the whole as important, at least in a physical and geographical point of view.

Since Mr. Ware's visit to this country we have been credibly informed of the discovery of the common Fig, the Plantain (*musa paradisiaca*,) and the Bamboo cane, (*Bambos arundinacea*,) near the shores of east Florida, to the south of the 28th degree of latitude. In another small collection I have also seen a species of Tournefortia.

MONANDRIA.

Salicornia herbacea. *Willdenow.* and *Pursh.*

DIANDRIA.

† Gratiola **micrantha*, caule erecto, angulato ; foliis lanceolatis acutis serratis basi attenuatis ; pedunculis foliis brevioribus ; calycibus (ebracteatis) quandripartitis, stamina 4.

Observation —A species of very unusual aspect; stem irregularly angular? apparently about a foot high, and considerably branched. Leaves narrow, and much attenuated below. Peduncles filiform, scarcely one third the length of the leaves. Segments of the calix 4-*parted*, naked, calix oval. Corolla (apparently minute, white ?) the internal surface of the tube densely covered with hairs. Capsules globose-ovate, crowned with the persisting style. The dissepiments of the 2-celled capsule formed by the inflected margins of the valves coalescing with the seminal placenta. Scarcely perhaps of this genus, but my specimens are too imperfect to warrant any additional remarks.

Pinguicula pumilla. *Mich.* Flor. Am. 1. p. 11.

Gratiola acuminata. *Walter* and *Elliott.* p. 15, not of Pursh. G. anagallidea. *Mich.* 1. p. 5. Excluding Pursh and Elliott's synonim of Lindernia.

Elytrania virgata *Mich.* 1. p. 9.

Salvia azurea. *Lamark*, Encycl. 6. p. 625. S. lyrata. *Lin.*

Piper **leptostachyon*, herbaceum, pusillum ; foliis obovatis obtusis subtrinerviis pubescentibus ; spicis axillaribus filiformibus erectis foliis multo longioribus. *Hab.* In East Florida.

Observations.—Apparently annual. The stems about a span high, in the dried specimen are clothed with short rupous hairs, which are more or less abundant—also upon the leaves. Leaves opposite, petiolate ; spikes filiform, sometimes more than one in each axill, three or four inches long. Stamens apparently two, persistent with the

fruit. Berries about the size of tobacco seeds. Considerably allied to *P. alpinum* of Jamaica.

TRIANDRIA.

Tripterella coerulea, *Muhlenburg's Catalogue. Elliot.* p. 43. *Nuttall's* Genera. Am. Pl. 1. p. 22.

Dilatris Heritiera. *Persoon's* Synopsis. 1. p. 54.

Sisyrinchium. anceps. *Lam.* Encl. 1. p. 403. *Willd.* 5. p. Pl. 3. p. 579.

Boerhaavia erecta. *Willd. Elliot.* p. 41.

Xyris caroliniana. *Lam.* Illustr. 1. p. 132. *Walter.* Flor. Carolin. 69. X. Jupicai. *Mich.* 1. p. 23.

Dichroma Cencocephala. *Persoon.* 1. p. 57.

Scirpus lacustris. *Willd.*

Dulichium. spathaceum. *Persoon.* 1. p. 65.

Arundinaria macrosperma. *Mich.* 1. p. 74. and *Beaurois* Miegia. *Persoon.* 1. p. 102. *Triglossum* of Fischer's Catal. du jardin des plantes, 1812, with a figure, appears to be nothing more than this plant.

Agrostis indica. *Willd. Persoon.* 1. p. 76.

Aulaxanthus ciliatus. *Elliott.*

Panicum Walteri. *Pursh.* Flo. Am. 1. p. 66. P. gibbum. *Elliott.*

Pennisetum violaceum? *Persoon.* Synop. 1. p. 72.

Trichochloa sericea. T. capillaris. *Decandolle* stipa sericea. *Mich.* 1. p. 54. Agrostis sericea. *Nuttall's* Genera. 1. p. 44.

Andropogon virginicum. *Willd.*

Uniola paniculata. *Willd.* 1. p. 406.

Chloris petraea. *Swartz.* Flor. 1. p. 194. *Persoon.* 1. p. 87.

Monocera aromatica. *Elliott.* Chloris monostachyd. *Mich.*

Rotbollia rugosa. *Nuttall's* Genera. 1. p. 84.

Lechea minor. *Lin.*

Erio caulon decangulare? *Mich.*

TETRANDRIA.

Rubia Browner. *Mich.* 1. p. 81.

Diadia virginica. *Willd.* 1. p. 580.

Oldenlandia glomerata. *Mich.* 1. p. 83.
Houstonia rotundifolia. *Mich.* 1. p. 85.
Ludiwigia hirsuta, *Lamark* Encycl. 3. p. 587.
L. linearis. *Walter.* Flo. Carol. p. 89.
L. lanceolata. *Elliott.* p. 213.
L. capitata, *Mich.* 1. p. 90.
Lycium carolinianium. *Mich.*
Rivina humilis. *Willd.*
Ilex, opaca. *Aiton.* Hort. Kew. 1. p. 169.
I. Dahoon. *Walter.* Flor. Carol. 241.

Ilex. **laurifolia*, foliis majoribus ellipticis, subacutis integerrimis semper virentibus, pedicellis elongatis subtrifloris.

Observations.—Nearly allied to I. *Dahoon.*

Obolaria virginica. *Lin.*

PENTANDRIA.

Purshia. hispida. *Sprengel.* Onosmodium hispidum. *Mich.* 1. p. 133.

Ipomoea maritima. *Brown's* Prod. Flor. Nov. Holland. p. 486. Convolvulus maritimus. *Brown's* Jamaica, p. 153. Ipomoae. obicularis. *Elliott.* p. 257. Ic. Botan. Rep. t. 319.

T. Bona nox. *Pursh.* 1 p. 145. Not perhaps of Linnæus.

T. mechoacanna. mechoacanna alba. *Banhin.* T. macrorhiza. *Mich.* 1. p. 141. Exclude the synonym of T. Ialapa. *Pursh.* 1. p. 146.

Ipomeria coronopifolia, Cantua coronopifolia. *Willd.*

Phlox divaricata. *Lin. Persoon.*

Solanum verbascifolium. *Willd. Pluck.* Almag. 351. t. 316. f. 1.

Capsicum baccatum. *Lin.* The fruit according to Mr. Ware, is about the size of a pea, somewhat oblong, and, as usual, red when ripe. This species commonly used in Florida as a condiment by the inhabitants, is in common with the Cayenne pepper of Jamaica, called "Bird Pepper." It is the pepper spoken of by my friend Wm. Bartram, in his Book of Travels, page 71, and may probably be the *Capsicum baccatum* B. *minimum* of Miller, from which, as well as C. *baccatum.* of its more usual aspect.

The Cayenne pepper of commerce is manufactured. It appears to be perfectly distinct from the capsicum minus, fructu parvo pyramidali erecto," of Sloane t. 146. fig. 2. which appears also to afford the Cayenne pepper.

Psychotria **lanceolata*, stipulis amplexicaulibus subrotundis deciduis; foliis lanceolatis utrinque acuminatis, subtus pubescentibus; pedunculis trichotomis paucifloris.

Observations.—Stem shrubby; the younger branches, and under side of the leaves, more particularly when young, as well as the peduncles, clothed with a ferruginous pubescence. Leaves opposite, two to three inches long, and about an inch wide, prominently and somewhat verticulately veined. Stipules sphacelous, brownish, and deciduous. Flowers not seen. Peduncles mostly terminal, one to two inches long, trichotomal and few flowered. Berries red, ovate; nuts two, externally convex and grooved. One of the specimens is perfectly smooth and produces smaller leaves, but in other respects appears the same.

Ophiorhiza mitreola. *Willd.*

V. Lanceolata. *Elliott.* Cynoctonum petiolatum. *Gmelin.* Syst. Veg. 443.

Sabbatia paniculata. *Pursh.*

S. calycora. *Mich.* Flor. 1 p. 147.

S. Gracilis. Chironia gracilis. *Mich.* 1 p. 146.

Chiococca racemosa. *Willd.* Sp. Pl. 975.

Caprifolium sempervirens. *Mich.* 1 p. 105.

Vitis rotundifolia. *Mich.*

V. palmata? *Persoon.* 1 p. 252. This plant, however, scarcely appears to be more than a variety of V. *æstivalis*, and instead of being smooth, is tomentose.

Itea virginica. *Mich.* 1 p. 157.

Cyrilla **paniculata*, foliis coriaceis cuneato-oblongis obtusis, floribus paniculatis.

Observations.—Nearly allied to C. *antillana* of Michaux, but the flowers are distinctly paniculated. The leaves are sometimes apparently oblong-lanceolate. The petals are oblong and spotted or blotched.

Plumbago **floridana*, herbacea? erecta: foliis petiolatis ovatis glabris, caule æquali.

Observations.—Scarcely distinct from P. rosea, but bearing white flowers like P. *scandens*, of which it may be perhaps a variety.

Rhamnus minutiflorus. *Mich.*

Ceanothus microphyllus. *Mich.*

Herniaria * *americana*, procumbens, glabriusculis, foliis lineari-oblongis internodiis multo brevioribus, stipulis minutis, fasciculis, paucifloris, cal, laciniis obtusis coarctatis. P. *Anychia herniaroides*, Elliot, not of Michaux.

Perhaps the supposed *Camphorosma glabra ?* The stem is clothed with a minute retrorse pubescence. The clusters of flowers contain from about three to five ; the upper and inner part of the calyx is whitish.

Matelea ? * *lævis*, foliis lanceolatis utrinque acuminatis, umbellis longe pedunculatis, axillaribus, folliculi lævi tereti.

Observations.—Stem herbaceous, and terete with an alternating line of pubescence. Leaves opposite, lanceolate and acuminate, petiolate. Umbels axillary on longish peduncles. Calix five-parted, segments acuminate. (Corolla not seen.) Follicle acuminated at either extremity, smooth and even. Seeds destitute of pappus, (but in other respects resembling those of *Asclepias*, elliptic, with a broadish membranaceous margin, imbricately attached to a somewhat slender unconnected central receptacle. On a careful examination of Aublet's figure and description of *matelea*, I am fully satisfied that it is a congener of the present plant, although we are yet unacquainted with the corolla of this species. The anthers, as they were then considered, though so singularly described by Persoon, (Synopis, 1. p. 276,) are evidently on the authority of Aublet's description, similar to those of Asclepias and Cynanchum, to which the genus holds a near affinity. The specimen also collected by Mr. Ware, might from its whole habit be readily taken for an Asclepias.

Cynanchum * *scoparium*, denudatum; caule volubili perenne, foliis liearibus remotis, umbellis subsessilibus parvifloris.

Observation.—Stem green and perennial, striated, and with the exception of the recent branches naked ; branches opposite, furnished with an alternating pubescent line.

Branches opposite, leaves narrow, linear, acute, smooth, and membranaceous. Flowers greenish yellow, minute. Segments of the calix very obtuse and short, those of the corolla oblong, with a brownish line towards the base of each. Lepanthium very short, five toothed. Polliniferous cells as in Asclepias. Follicles terete, even, and subulate. Seeds linear and immarginate.

Asclepias verticillata. *Lin.*
A. incarnata. *Willd.*
Amsonia Angustifolia. *Mich.*
Gentiana catesbrei. *Walter.*
Eryngium. virginianum. *Persoon.*
E. aromaticum. *Baldwin* in Elliot's Flora, p. 344.
Peucedanum ternatum. *Nuttall's* Genra. 1. p. 182.
Salsola salsa. *Willd.*
Statice Limonium. *Lin.* S. Caroliniana. *Walter* Flor. Car. 118.
Linum Virginicum. *Lin.*

HEXANDRIA.

Tillandsia * *Bartrami*, foliis ensiformibus attenuatis glabris, panicula multiflora : floribus alternis distinctis. T. *lingulata* or Wild Pine. Bartram's St. p. 61.

T. polystachya. *Muhlenberg's* Catal.

Observations.—Leaves all radical, two or three feet long, attenuated, having broad sheathing bases, crowded together so as to form a vase for retaining water. Panicle naked, very large, formed of alternate branches, incumbent on each other, including the scape, commonly about three feet high. The flowers are distinct and alternate, each subtended by an ovate obvallate bracte. (Flower not seen.)

Mr. Ware plucked one specimen from the trunk of a live oak. which he supposed to weigh about fifteen pounds.

T. tenuifolia, Swartz. Fl. Ind. acc. 1. p. 592.
T. *monostachya*. Bartram's H. p. 61.

Observations.—Leaves subulate, erect, and about the height of the flower stem, covered as in U. Usneoides with heavy surpuraceous scales, scape covered with sheathing bractes, flowers imbricated into a single, linear oblong

spike. In more luxuriant specimens, it is probable there occur the three spikes which characterize this species. (Flowers not seen.) It appears to be very nearly allied to T. canescens.

T. recurvata, Flor. Peruv. t. 271. *Lin. Persoon.* 1. p. 346.

Prinos coriaceus? *Pursh.* Flor. 1. p. 221.

Observations.—Leaves sempervirent, oval, or cuneate-oval, subserrate towards the apex, pedicels many-flowered, short, and corymbose.

Crinum Americanum. *Ait.* Hort. Kew. 1. p. 413.

Sabal Adansoni, *Persoon.* 1. p. 399.

S. Histrix. *Pursh.* caudice repente, frondibus palmatis plicatis, axillis spinosis, spadicibus brevissimis, drupis ovoideis, majusculis hirsutis.

Observations.—In this species, whose fronds resemble the preceding, the stipe is naked and triangular, not simply convex beneath; in the basilar axils of which originates a matted tomentose substance, almost similar to coarse brown wool, and intermixed with spines half a foot long, and rigid as needles, within these radical sheathes is inclosed the clandestine spadix loaded with hirsute brownish drupes the size of coffee berries, and when recent possessing an eatable sweetish pulp, with which the aborigines are acquainted.

S. * *minima*, caudice repente, stipitibus subaculeolatis asperis, frondibus palmatis plicatis, subseptemfidis?

Observations.—The frond scarcely exceeds a span in height, and is not a variety of S. *serrulata*, as Mr. Ware observed it to form almost exclusive fields of an uniform appearance.

OCTANDRIA.

Rhexia angustifolia, *Nuttall's* Gen. 1. p. 244.

Œnothera humifusa, *Nuttall's* Gen. 1. p. 245.

Gaura angustifolia, *Mich.* 2. p. 226.

Polygonum gracile, *Nuttall's* Gen. 1. p. 255.

This species, according to the observations of Mr. Ware, attains the height of three or four feet.

P. parvifolia, *Nuttall*, 1. p. 256.

P. polygamum. Vent. Hort. Cels. p. 65.

Polygonella parvifolia, *Mich.* 2. p. 241.

Amyris *Floridana, foliis ternatis, foliolis ovatis integerrimis obtusis glabris, floribus subpaniculatis, baccis subgloboris, basi attenuatis.

Observations.—A shrub six or eight feet high with a smoothish pale bark. Leaves ternate, petiolate, lucid and apparently sempervirent, reticulately nerved on either side, and crowded with fragrant resinous glands. Calix four-toothed, (corolla not seen.) Berries black, about the magnitude of black pepper, and very fragrant, containing a thin fragile nut inclosing a single seed with a greenish pulp. It is perhaps scarcely distinct from A. maritima, and in every respect but the pinnated leaves, like Sloane's figure, vol. I. t. 199. of Terebinthus major. We should also take it to be the Amyris, figured by Catesby, but for the perfect smoothness of the leaves.

ENNEANDRIA.

Laurus geniculata, *Mich.* 1. p. 244.

Eriogonum, tomentosum, *Mich.*

DECANDRIA.

Vaccinium. myrsinites. *Mich.* 1. p. 233.

Andromeda mariana. *Lin.*

A. marginata. *Duhamel.* A. nitida. *Mich.* 1. p. 252.

Kalmia hirsuta. *Willd.* sp. pl. 2. p. 601.

Monotropa uniflora. *Lin.*

Jussieua erecta. *Willd.* 2. p. 578.

Jussieua *tenuifolia, foliis sessilibus linearibus glabris, floribus sessilibus octandris.

Observations.—This specimen, which is very imperfect, presents a longish slender branch with a few remote flax-like leaves and remote quadrangular capsules; it is suffi-

ciently distinct from the other species indigenous to the U. States.

Cassia nictitans. *Willd.*
Stellaria elongata. *Nuttall's* p. 289.
Limonia acidissima? *Lin.*

Observations.—Perhaps a distinct species. As the spines, or rather prickles, are by pairs. The leaflets are small, roundish-oval and crenated. It bears considerable resemblance to the figure in the Flora malabarica quoted for L. crenulata, but is in all probability a distinct species, and my specimen is too imperfect for description.

ICOSANDRIA.

Chrysobalanus oblongifolius. *Mich.* 1. p. 283.
Lythrum virgatum. *Willd.*
Sesuvium pedunculatum. *Decandolle.* Leaves linear-oblong. Anthers purplish red.
Aronia arbutifolia. *Perssoon.*

POLYANDRIA.

Befaria racemosa. *Mich.*
Helianthemum canadense. *Willd.*
Rhizophora mangle. *Lin.* Cateshys Carolina, 2. p. 63 t. 63.
Ascyrum amplexicaule. *Mich.* 1. p. 77.
Hypericum galioides. *Willd.*
H. sphærocarpum? *Mich.*
Magnolia glauca. B *pumila, foliis ellipticis utrinque acutis.

Observations.—A dwarf variety not exceeding three or four feet.

Porcelia pygmæa. *Persoon.* 2. p. 95.
Clematis viorna. *Willd.* Sp. Pl. 2. p. 1288.
Cyamus luteus. nelumbium luteum. *Willd.*

DIDINAMIA.

Dracocephalum virginianum. *Willd.*

Hyptis capitata. *Willd.* Sp. Pl. 3. p. 84.

Hyptis spicata. *Poiteau* in Annales du museum. 7. p. 474. t. 28. f. 2.

First found by Richard in the island of St. Domingo.

Calamintha caroliniana. Thymus carolinanus. *Mich* 2. p. 9.

Trichostema dichotoma. *Lin.*

Verbena caroliniana. *Mich.*

Lantana Camara. *Lin.*

Bignonia capreolata. *Lin.*

Ruellia strepens. *Lin.*

Buchnera americana. *Lin.*

Avicennia tomentosa. *Willd.*

Observations.—This shrub grows also around the Balize near the mouth of the Mississippi, where, as in Jamai- it is called mangle. The present plant agrees precisely with Sloane's figure, but is in all probability a distinct species from that of Rheed in the Flora malabarica, vol. 4. t. 45. in which the flowers are produced in longish pedunculated panicles, while in the present plant they are aggregated in almost sessile clusters. Besides which, the Avicennia of India is a stately tree, seventy feet high, and often sixteen feet in circumference, while the Floridian plant is merely a sempervirent shrub.

Gerardia linifolia. *Nuttall's* Genera. 2. p. 47.

Seymeria tenuifolia. *Pursh.* Flor. Am. 2. Suppl. p. 737. *Nuttall's* Gen. 3. p. 50.

Pentstemon pubescens. *Aiton.*

P. lævigatum. *Willd.*

Schwalbea americana. *Lin.*

Orobanche americana. *Lin.*

TETRADYNAMIA.

Arabis Canadensis. *Lin.*

A. bulbosa. *Wild.*

Stanleya? *amplexifolia*, foliis integris? amplexicaulibus, floribus corymbosis siliquis nutantibus.

Observations.—Of this plant whose genus is consequently doubtful, we have seen only seeding specimens which Mr. Ware collected in the arid pine forests. The whole plant appears to have been smooth and glaucous, the stem terete, herbaceous, low, and branching towards the summit. With the radical leaves we are unacquainted, those few which remain on the stem are cordate-ovate, amplexicaule, and entire. The flowers have been aggregated in a close corymb; the peduncles are filiform. The siliques curved downwards, are conspicuously stipitate, flat, and two and a half to three inches long, the stipe about three fourths of an inch, with the peduncle somewhat shorter. The dissepiment is equal and parallel with the valves. The seeds are alternately attached to either side the suture of the dissepiment, and are small brown, oval, striated and compressed. The cotyledones are simple or undivided, and the radicle curved.

MONADELPHIA.

Lobelia crassiuscula. *Mich.*

Lobelia **aphylla*, minima; caule filiformi subsimplici squamosa, pedunculis remotis elongatis.

Observations.—Found by Mr. Ware in shady swamps accompanying *Tripertella coerulea*, from which the dried specimens are scarcely distinguishable. Root perennial. Stems filiform, four to six inches high, generally simple, bearing from about one to five remote, long pedunculated flowers. Capsule elliptic-ovate.

Passiflora *Warei, foliis inferioribus trilobis acutis, superioribus indivisis ovatis, petiolis, biglandulosis, pedunculis, subgeminis.

Observations.—Lower part of the stem suberose. Leaves smooth and shining, of a thin consistence, having short biglandular petioles, the lower ones two and three lobed, the upper simply ovate, all acute. Stipules none. Peduncles commonly a pair in each axill, about the

length of the petiole. The flowers are very small. The calix formed of consimilar ablong-linear segments. Filiform segments of the crown, (or lepanthium) few, and shorter than the calix Berries about the size of peas, purple.

Oplotheca Floridana, *Nuttall's* Genera 2. p. 79.
Pistia spathulata. *Mich.*
Sida rhombifolia. *Wild.*
Hibiscus **pentaspermus*, H. Virginicus. *Mich.* 2. p. 46.

Observations —Leaves partly hastate, the lower ones subsessile. Flowers small, red, with a yellow base, partly disposed in irregular few-flowered racemes. Exterior calix, as usual multifid and filiform. Capsule hirsute, depressed, pentangular, five-celled, indivisible, each cell one-seeded. This species is nearly allied to *urena*. *Hab.* from Cape Henlopen to East Florida.

DIADELPHIA.

Petalostemon corymbosum. *Mich.*
Petalostemon **roseum*, glabrum, foliolis linearibus, bracteis subulatis brevissimis persistentibus; calycibus striatis glabris.

Observations.—A species possessing very much the habit of P. violaceum, but with the calix perfectly smooth, and the petals of a rose colour.

Polygala pubescens. *Nuttall's* Genera 2. p. 87.
P. lutea *Wild.* Sp. Pl. 3. p. 894.
Erythrina herbacea. *Wild.* 3. p. 912.
Lathyrus palustris. *Wild.* 3. p. 1000.
Psoralea.
Lupinus diffusus. *Nuttall's* Gen. 2. p. 92.
Hedysarum paniculatum. *Wild.*
Æschynomene viscidula. *Mich.* 3. p. 74.
Sesbania platycarpa. *Persoon.* Syn. 2. p. 316.
S. Macrocarpa. *Nuttall's* Gen. 2. p. 114.
Glycine erecta. *Nuttall's* Gen. 2. p. 114.
G. caribaea. *Wild.* Jacquin. Tc. rar. 1. t. 146. G. reflexa. *Nuttall's* Gen. 2. p. 115.
Indigofera caroliniana. *Walter. Mich.* 2. p. 68.

SYNGENESIA—ÆQUALIS.

Prenanthes racemasa. *Mich.* 2. p. 94.

Prenanthes, *aphylla*, foliis paucissimis subulatis brevibus, caule simplici superne nudo; calycibus, multifloris.

P. Aphylla, *Nuttall's* Genera. 2. p. 123.

Observations.—Root perennial. Stem about two feet high striated, in the specimen under examination, producing but two subulate leaves near its base, the lower one about an inch and a half, the upper one less than half an inch ; the rest of the stem perfectly naked, and producing two unequally pedunculated large pale rose red flowers; at the base of the stem there is a single sphacelous abortive scale ; the calix is subtended by a considerable number of imbricated lanceolate scales. Florets about twelve ligulate, and twelve tubular.

Liatris graminifolia. *Pursh.* 2. p. 408.

L. elegans. *Willd.* 3. p. 1635.

L. tenuifolia. *Nuttall's* Gen. 2. p. 131.

L. paniculata. *Willd.* 3. p. 1637.

L. corymbosa. *Nuttall's* Gen. 2. p. 132.

Liatris * *oppositifolia*, foliis lanceolatis, sub oppositis nervosis, caule ramoso, ramulis paniculato-corymbosis, calycibus cylindraceo-ovatis parvulis sub 15—20-floris, squamis oblongis obtusis intimis, coloratis pappus scabriusculis.

Hab. discovered also near New-Orleans and communiacted to me by Dr. Harlan, of Philadelphia.

Observations.—Root perennial? The whole plant pubescent. Stem terete, a little below the summit, oppositely branched, the branches corymbiferous. Leaves small, ovate-lanceolate, about three-nerved, on the branches sometimes alternate. Flowers small, resembling those of L. paniculata, but more numerous. Scales of the calix striate, unequal, the interior ones coloured and elongated. Pappus merely scabrous, not plumose.

Liatris **fruticosa*, glabra ; caule fruticoso, ramis corymbosis, foliis cuneato-obovatis punctatis, calycibus subquinquefloris, laciniis acuminatis.

Observations.—A brittle branched shrub with rather crowded leaves, shaped like those of common purslain Portulacca oleracea,) branchlets attenuated and almost, naked above. The calyx narrowed at the base, is formed of a few imbricated, linear-lanceolate, and acuminate scales, (in a dried state,) shining with resinous atoms as in the Eupatoriums Florets purple, the pappus also tinged with the same colour. The corymb of flowers in this species, with the exception of colour, could scarcely in any respect be distinguished from those of *Kuhnia Critonia.*

Eupatorium coelestinum. *Willd.*
E. foeniculacium. *Willd.*
Mikania scandens. *Willd.*
Polypteris integrifolia. *Nuttall's* Gen. 2. p. 139.
Melananthera hastata. *Mich.*

SYNGENESIA.—Superflua.

Baccharis halimifolia. *Lin.*
B. angustifolia. *Mich.* 3. p. 125.
Conyza pycnostachya. *Mich.* 2. p. 126.
Erigeron pusillum. *Nuttall's* Gen. 2. p. 148.
E. philadelphicum. *Willd.*
Inula (*Chrysopsis*) gossypina. *Mich.* 2. p. 122.
I. scabra. *Pursh.* 2. p. 531.
I. graminifolia. *Mich.* 2. p. 122.
I. divaricata. *Nuttall's* Gen. 2. p. 152.
I. obovata. *Nuttall's* Gen. 2. p. 152.
Aster montanus. *Nuttall's* Gen. 2. p. 156.
A. carolinianus. *Walter. Willd.* 2. p. 2017.
Solidago pyramidata. *Pursh.* 2. p. 537.
S. lacevigata. *Willd.* 3. p. 2063.
Selloa * *nudata*, radiis paucissimis, floribus corymbosis, bracteis filiformibus, foliis integerrimis linearibus oppositis glabris. *Hab.* East-Florida.

Observations.—Perennial ? Stem smooth and angular. Leaves opposite linear, rather thick and smooth. Corymb compound, trichotomous. Flowers yellow, scarcely distinguishable from those of solidago, except by the paucity of rays. Calyx five-leaved, cylindric, coloured. Rays often altogether wanting ? (in my specimen,) never more than

one. Florets five to eight. Pappus more. Seed smooth and black. The genus has been recently formed by sprengel, and founded on Brasilian species. The present plant appears to be allied to *Chrysocoma.*

Boltonia asteroides. *Willd.* 3. p. 2162.
Eclipta procumbens. *Mich.* 2. p. 129.
Verbesina virginica. *Willd.* 3. p. 2222.
Tetragonotheca helianthoides. *Willd*, 3. p. 2116.
Buphthalmum frutescens. *Willd.* 3. p. 2229.

SYNGENESIA.—Frustranea.

Galardia bicolor. *Willd.* 3. p. 2245.
Balduina multiflora. *Nuttall's* Gen. 2. p. 176.
Helianthus tracheliflorus. *Willd.* 3. p. 2241..
Rudbeckia hirta. *Willd.*
Biclens chrysanthemoides. *Willd.* 3. p. 1717.
Actinomeris * *pauciflora*, foliis oblongis serrulatis decurrentibus nudis paucifloris.

Observations.—Stem apparently simple: Leaves opposite oblong or oblong ovate. Peduncle few-flowered, long and naked, (in my specimen, two-flowered. Calix composed of about a simple series of lanceolate leaves. Seeds winged on the margin, shortly two-horned. (Flowers not seen.)

SYNGENESIA.—Necessaria.

Silphium * subacaule, scabriusculum: caule brevissimo, pedunculis longissimis, foliis oblongis subsinuata-pinnatifidis dentatis, calycinis foliolis dilatatis rhomboideis.

Observations.—A species very remarkable for its diminutive stature, the stem being often altogether wanting, and at most but two or three inches high. Leaves sessile, alternate, two or three inches long, with the margin alternately sinuated so as almost exactly to resemble the leaves of some species of Senecio. Peduncle nearly a span long. Flowers, as usual, yellow. The seeds also conformable with the genus.

SYNGENESIA.—Segnegata.

Elephantopus carolinianus. *Willd.* 3. p. 2390.

GYNANDRIA.

Maranta arundinacea, culmo ramoso herbaceo, foliis ovato-lanceolatis ; floribus subpaniculatis.

M. arundinacea, cannacori folio ; Mart. Cent. 39. t. 39.

Canna Indica, radice alba alexipharmica. *Sloane.* Jam. 1. p. 253. t. 149. f. 2. Representing merely the figure of the leaf, and says that it had been introduced into the island of Jamaica from Dominica. It is believed to be a native of South America.

Tc. Redoute's Liliacea, t. 57.

This plant was seen in extensive marshy fields by Mr. Ware, about the latitude of 28°, and agrees in every important particular with the officinal plant, except in the absence of hairs upon the leaves, the nodes are, however, pubescent. The fruit by abortion presents a round one-seeded nut.

Maranta arundinacea. B. pumila, culmo simplici, floribus fasciculato-paniculatis.

Observations.—Perhaps the mere autumnal shoots of the preceding ; Mr. Ware, however, considered it as something distinct from its uniform dwarf habit.

Habenaria repens? *Nuttall's* Gen. 2. p. 190.

Cranichis multiflora. Elliot. *Nuttall's* Gen. 2. p. 191.

Observations.—Leaves nearly all radical, ovate, one or two however embracing the lower part of the stem. Upper part of the stem pubescent. Flowers greenish, somewhat remote, about twenty, more or less, forming a raceme four or five inches in length. Bractes ovate and acuminate of a sphacelous membranaceous consistence, and less than one half the length of the germ. Cateral segments of the corolla, ovate and oblique, connivent with the uppermost ; innermost segments dilated, broader and nerved. Lip inverted or situated behind, unguiculated, the lamina concave, and abruptly accuminated. Column

or style concave nearly its whole length, including two? masses of sulphur yellow farinaceous pollen, the concavity or cell closed by a lanceolate oblong articulated operculum.

Triphora pendula, *Nuttall's* Gen. 2. p. 193.
Arethusa pendula. *Willd.*
Neottia tortilis. *Willd.*
N. cernua. *Willd.*

MONOECIA.

Urtica. Apparently new, but too imperfect for description.

Parietaria floridana. *Nuttall.* 2. p. 208.
Amaranthus pumilus. *Nuttall.* 2. p. 210.
Quercus virens. *Willd.*
Quercus laurifolia. *Willd.*
Q. maritima. *Willd.*
Q. imbricaria. *Willd.*
Carya aquatica. Juglans aquatica. *Michaux.* Arb. Forest.
Pinus palustris. *Willd.*
Acalypha caroliniana. *Willd.*
Croton maritimum. *Willd.*
C. glandulosum. *Willd.*
Ephorbia cyathophora. *Willd.*
E. maritima.
Jatropha manihot? *Lin.*

The celebrated root from which the Cassava bread is made, and which, according to Thenet, was used over an extent of two thousand leagues. Sloane also adds, "It is of the most general use of any provision all over the West Indies, especially the hotter parts, and is used to victual ships." Hist. 1. p. 130. The sap of the root, which in a raw state is poisonous, " evaporated over the fire, gives the Tapioca meal, and the leaves, when boiled, are eaten after the manner of spinage. Sloane's Hist. vol. I. p. 131. In the specimen collected by Mr. Ware, the lobes of the leaf instead of being simple are subdivided. It may still, however, be the same plant in a state of luxuriance.

Stillingia sylvatica. *Willd.*

Phyllanthus obovata. *Willd.* Apparently perennial by the effect of climate.

Forestiera ligustrina. *Poiret.*
Borya ligustrina. *Willd.*

DIAECIA.

Ceratiola ericoides. *Mich.* 2. p. 222.
Viscum verticillatum. *Lin.*
Iresine elatior. *Willd.*
Zamia integrifolia. *Mich. Willd.*

Observations.—The farina of the root of this plant is much esteemed as food by the Indians, appears to be but little inferior to the Arrow-root.

CRYPTOGAMIA.

Lycopodium alopecuroides. *Willd.*
Vittaria linearis. *Willd.*
V. angustifrons. *Mich.* 2. p. 261.
Osmunda cinnamonea. *Willd.*
Polypodicum. A fragment of a very large species.
Aspidium.

MATHEMATICS.

Art. XIII.—*Review of the Cambridge course of Mathematics.*

1. An Elementary Treatise on Arithmetic, taken principally from the Arithmetic of S. F. Lacroix, and translated into English, with such alterations and additions as were found necessary in order to adapt it to the use of the American student. Second Edition, revised and corrected. pp. 128.

2. An Introduction to the Elements of Algebra, designed for the use of those who are acquainted only with the first principles of Arithmetic. Selected from the Algebra of Euler. Second Edition. pp. 216.

3. Elements of Algebra, by S. F. Lacroix. Translated from the French, for the use of the students of the University at Cambridge, New England. Cambridge, N.E. Hilliard and Metcalf, 1818. pp. 263.

M. Lacroix, the author of the first and third volumes before us, has long been distinguished as a writer upon the pure mathematics. His mathematical works commence with common arithmetic, and end only with the highest point, to which the science of calculation has been carried. Most of his treatises have passed through many editions, and are generally used in France, both for public and private instruction. They are connected with each other by references, a circumstance which adds greatly to the convenience and facility of reading them; and they are probably more complete, and of a higher scientific character, than any other course, which has hitherto been published. His Arithmetic and Elements of Algebra, form the two first volumes of his course, and of these it will be our duty soon to speak particularly. His third volume is upon the Elements of Geometry. This is followed by an elementary treatise on rectilineal and spherical Trigonometry, and on the application of Algebra to Geometry, and by supplements to the elements of Algebra and Geometry. This last supplement is a treatise upon Descriptive Geometry, a branch of Mathematics which has been recently opened, or rather which has recently been reduced to rigorous principles, and been used as an instrument of investigation. It has not been much cultivated out of France.* It was established as a branch of instruction in the Normal School, created by a law of 30th October, 1794, and three Professors were appointed for the object, among whom was M. Lacroix.

Descriptive Geometry has two objects; the first is, to represent with exactness, upon surfaces which have but two dimensions, objects which have three dimensions, and which are susceptible of a rigorous definition. Under this point of view, it is a language more perfect than any other

* We observe with pleasure, that Mr. Croyt, Professor of Engineering in the Military Academy of the United States, has published the first part of a treatise on Descriptive Geometry, for the use of the Cadets of that institution.

for communicating every thing capable of delineation or construction, and particularly forms the foundation of the graphic arts. Its second object is, to deduce from the exact delineation of objects, every thing which results from their respective forms and positions. In this way, as it offers continual examples of passing from what is known to what is unknown, it becomes an instrument of investigating new truths. The most complete work on this subject, we believe, is, Monge's Géométrie Descriptive with M. Hachette's supplement.

The next volume of M. Lacroix's course, is an elementary treatise on the differential and integral calculus, of which a translation was some years since published in England. Then comes an elementary treatise, on the calculation of probabilities. The course concludes with a volume consisting of Essays on Instruction in general, and on that of the mathematics in particular; or the method of studying and teaching mathematics. This volume, we hesitate not to say, contains views of study and instruction of the very first importance, founded on a knowledge of the human mind, and on experience gained by directing the studies of a great number of young men, during a long course of years. It also sheds much light on many parts of the other volumes which compose the course, and we shall often have occasion to refer to it in the course of the present article.

The principal remaining work of Lacroix, is his "Traité du Calcul Differentiel, et du Calcul Integral," 3 Tom. 4to. In this work, he professes to have collected and systematically arranged whatever is most valuable in the treatises of of Euler, Lagrange, &c., and in the numerous analytical memoirs scattered through the volumes of the different learned societies and academies of Europe. This vast quantity of materials, receiving from the vigorous and systematic mind of Lacroix uniformity of style and development, is incorporated into one great work, every part of which is impressed with the genius and luminous views of the author, and from which a knowledge of the transcendant analysis, in its present improved state, can be obtained.* (Edinb. Encyc. vol. IX. 116.) While this treatise was in preparation, the author received a letter from the celebrated Laplace, of which the following is an extract. "Je vois,"

says he, "avec beaucoup de plaisir que vous travaillez à un grand ouvrage sur le calcul integral.....Le rapprochement des Méthodes que vous comptez faire, sert à les éclairer mutuellement, et ce qu'elles ont de commun renferme le plus souvent leur vraie métaphysique; voila pourquoi cette métaphysique est presque toujours la derniere chose que l'on découvre. L'homme de génie arrive comme par instinct aux resultats; ce n'est qu'en réfléchissant sur la route que lui et d'autres ont suivie, qu'il parvient a généraliser les Méthodes, et à en découvrir la metaphysique."

As a mathematical writer, Lacroix appears to have formed himself on the model of Clairaut and Euler. In clearness and eloquence, he falls not much below the latter, and in the profoundness, extent and originality of his views, he is certainly inferior to neither. He is never a servile imitator of any of his predecessors. Although he freely makes use of their writings when they are to his purpose, yet whatever he takes from them, receives a new and original character from the view which he takes of it, and from the additional development which it often receives from him.

Of Euler it is not necessary to say much, to those who are, in any degree, acquainted with mathematical science. In clearness and elegance of demonstration and illustration, he stands the prince of mathematicians, and in fertilityof invention, he has never been surpassed. He is author of more than thirty separate works, and of nearly seven hundred memoirs, most of which are te be found in the volumes of the Academies of Berlin and St. Petersburgh.* (Condorcet, Eloge de M. Euler.) Again, says the Marquis de Condorcet, " tous les mathematiciens célebres qui existent aujourd'hui sont ses éleves. Il n'en est aucun qui ne se soit formé par la lecture de ses ouvrages, qui n'ait recu de lui les formules, la mêthode qu'il emploie, qui, dans ses decouvertes ne soit guidé et soutenu par le genie d' Euler."

The three volumes before us, are a part of the course of mathematics, which is preparing under the direction of Professor Farrar, for the use of the students of the University in Cambridge. The two first are required to be studied before admission, the last is a text book in the university course of instruction. Three other volumes have appeared, two on the pure, the other on the applied mathematics;

and these, we learn, are to be followed by others on the applied mathematics, making a complete course.

A course of mathematical instruction, and, indeed, a course of instruction of almost any other kind, may be considered in two points of view ; first in relation to the development of the faculties of the mind, and secondly, as furnishing results to be used for the practical purposes of life. Each of these objects is important, and both ought to be united, as far as possible, in a course of public instruction. The practical purposes to which mathematical learning is applied, are by no means few, nor of inconsiderable value. Commercial and political arithmetic, have the most important connexions with mercantile transactions, with practical legislation, and with the science of government. Mathematical principles form the basis of Geography, in determining the figure and dimensions of the earth, the situation of places upon its surface, &c.; of History, as connected with the chronology of events, &c. ; of Surveying, in which boundaries are to be traced, estates, provinces, canals, &c. laid out ; of Navigation, in which the course, latitude, longitude, &c. are to be determined ; of Architecture in which the strength of timber, the pressure upon each part, the best form of arches, &c. are to be calculated ; of Mechanics, in which the laws of motion, the composition of forces, the structure and equilibrium of machines, &c. are to be estimated ; of the science of War, in the planning of fortifications, in the theory and practice of gunnery, &c. ; of Optics, in explaining the laws of vision, in the theory of colours, and of the rainbow, and in the construction of optical instruments, &c. ; of Astronomy, in calculating the effects of that most extensive of all principles with which we are acquainted, the law of gravitation, upon the solar system, &c. ; of Music, in the propagation and comparison of sounds, in the theory of tones as connected with vibrations, &c. ; of the crystallo-graphic part of Mineralogy ; of Chemistry, especially in the doctrine of multiple proportions ; and in fine, of a great part of the whole circle of arts and sciences.* (Pres. Day's Algebra, p. 6.)

But it is particularly with a view to the development of the mental powers, that a course of mathematics is important. Granting, if it is possible, that the Physician, the Divine, the Advocate, or the Judge, may have forgotten eve-

ry proposition in Geometry, and every principle in Algebra; still he may be indebted to these sciences learned in early life, for no small part of his skill in separating error from truth, for his power of fixed attention, for his caution in admitting proof and in drawing conclusions, for the general discipline of his mental faculties, and his capacity for arranging all the parts of a long argument, so that it may result in the clear establishment of the desired truth. Such a habit of mind constitutes *true learning*, a rare acquirement; and ought to be the ultimate object of every system of education. It is capable of application to every subject, at all times, and in every situation. Without the accomplishment of this object, no education can be in a considerable degree complete, much less can the mind be highly cultivated.

It may be interesting to know the views of Lacroix in composing his course, and the principles by which he was guided. "Having been from early life," says he,* (Essais sur l'enseignement, p. 171,) "engaged in the labours of instruction, I always turned my attention upon the means of presenting the results of science by the most simple methods,(par les faces les plus simples,) and in the most natural order. With this view, I originally conceived the design of embodying in a series of volumes, all the materials of Geometry and of the transcendant analysis. Called to the functions of a professorship, which before I had performed only in schools, in which the form and matter of the instruction were rigorously fixed, and that of the Central Schools being left entirely at the disposition of the master, I was led by this liberty to reflect upon the means of perfecting the course which had been entrusted to me. I tried experimentally, upon a numerous class, (auditoire) the principles and the methods which I had conceived; their application served to confirm them, or sometimes modified them for the better."

Again, "teaching the sciences," says he,* (idem p. 173) "is subject to the same rules as that of the arts; the choice of examples is much more important than their numbers, a few truths thoroughly investigated, throw much more light upon the true method of procedure, than a great number of theories discussed in an incomplete manner. The first cast their roots deep, which cannot fail to spread themselves,

and from which spring trees whose numerous branches are loaded with fruit; the others, which have scarcely pierced the ground, soon disappear, after having offered a sterile aliment to vanity."

To speak more particularly, M. Lacroix appears to have been governed in preparing his mathematical works, by the following principles :—

1. To give a demonstration as rigorous as the nature of the case would admit, of every rule and principle of which any use is made. This is very different from the course pursued in *most American* and *English* books upon mathematics. In our treatises upon Arithmetic and Algebra, with a very few honourable exceptions, the rules are given in a very concise and purely didactic form, and whatever attempt there is at an investigation of them, is thrown into notes which are seldom much consulted. Nor is the student generally in blame for not consulting them, as they are usually so ill adapted to the state of his knowledge, that he finds it impossible to understand them. In Dr. Hutton's "course of mathematics," which will be admitted to be a pretty fair example, the rules of Arithmetic are demonstrated by algebraic methods, and the rules of algebra are usually without demonstrations. Now, by Lacroix and Euler, on the contrary, every thing is demonstrated in as rigorous a manner, as the state of the student's information will warrant. He sees at each step, the ground on which he is proceeding, and forms from the beginning, a *habit* of demonstration. The greatest part of the mathematical learning among us, we believe, is not much unlike that of the mere practical navigator, who knows what his book says, and how to apply what it says, but who is in Egyptian darkness with respect to the reason upon which any thing is said. A young man who accustoms himself from the first, to demonstrating every thing which he receives as truth, and to developing fully the conditions expressed or implied, of every problem which he solves, will soon form a habit of researches of this kind. Such a habit constitutes true knowledge in mathematics, and will furnish resources for unexpected cases where no rules are provided, or where a new combination of them is required; and where the mere mechanical calculator would find himself totally unable to proceed. But what is above all price, such a course most

effectually prepares a young man to pursue a course of discovery of his own, after becoming so thoroughly acquainted with the discoveries of others.

2. He avoids repetitions. (les doubles emplois* Essais. p. 180.) This becomes so much the more necessary, as the recent progress of the mathematical and physical sciences has greatly increased the mass of objects of instruction. He seldom employs different demonstrations to come to the same result; and never, unless it be in a succeeding part to give a more rigorous demonstration to a principle of extensive use which could not at first be demonstrated in a rigorous manner; or unless the second demonstration gives him occasion to make some new remark, or deduce some interesting principle.

3. He always chooses the most general methods. This rule is in some degree a consequence of the former, since by means of such methods, repetitions are most effectually avoided. "In instruction," says Laplace, "prefer general methods, take care to present them in the most simple manner, and you will find at the same time, that they are always the most easy."* (Essais p. 181.) It is time to distrust this predilection for particular methods, under the idea that they are more elementary than general methods; whereas the truth is, that they are preferred because more ancient, and more agreeable to habits previously acquired, and which are not easily reformed. It is erroneous and contrary to established experience, to suppose that general methods must be preceded by an exposition of particular methods. General methods have no need of any assitance of this kind, when they are suitably explained, and do not meet, *in the minds of those who study them, or judge of them*, with old ideas to be effaced, or old prejudices to be destroyed. If we prefer the synthetic methods, because we think them attended with more complete evidence, and that they speak more to the senses; we must recollect that the analytical methods are vastly more fertile, and that the writings of the great mathematicians of our age, are composed in the style of these methods which it is absolutely necessary to study, as soon as we rise above the elements.* (Essais p. 183.)

4. He makes use, as far as possible, of the analytic method. This method has been the great instrument of invention at all times in mathematical science, and has

certainly been too much neglected both in this country and in Great-Britain. This is best accounted for. perhaps, from the circumstance, that Sir Isaac Newton, from partiality to the ancient writers, delivered his splendid discoveries by the synthetic method,* and that his authority has influenced the greatest part of mathematicians who have written in his native language. The essential character of the synthetic method, is, that it always proceeds from the simple to the more complex, and is on that account well adapted to the communication of truth when once discovered. But it fails almost entirely in communicating to the mathematical reader, that spirit of invention, which may enable him, after perusing what is most valuable in the writings of others, to open a new track for himself. It seems particularly appropriate, that Algebra which is scarcely more than another name for Analysis,† should be communicated by the analytic, and not as has usually been done among us, by the synthetic method.

5. The treatises in question are so composed as to be preparatory and introductory to the higher and more difficult physical, astronomical and mathematical treatises. This circumstance can be no disadvantage to him who does not expect to pass the limits of the elementary part of the science, while it is of the utmost value to every one who designs to devote a considerable part of his life to mathematical learning. Such an one, is anxious to press forward to the works of the great masters of the science, and ultimately, if possible, to an acquaintance with the "Méca-

* Sir Isaac Newton appears originally to have made his discoveries by analysis, and afterwards, in communicating them to the world, to have clothed them with a synthetic demonstration, with a view to render them more fit to meet the public eye ; he thus expresses himself in his treatise of Fluxions : Postquam area curvæ alicujus ita (analyticè) reperta est et constructa, indaganda est demonstratio constructionis, ut omisso, quatenus fieri potest, calculo algebraico, theorema fiat concinnum et elegans ac lumen publicum sustinere valeat." Newtoni opuscula, vol. I. p. 170.

M. Laplace thinks that Newton had found the greatest part of his theorems by analysis, but that his predilection for synthesis, and his great esteem for the geometry of the ancients, made him deliver, under a synthetic form, his theorems and even his method of fluxions. Exposit. du Syst. du Monde 4th edit. p. 422.

† Some writers on mathematics make a distinction between analysis and algebra. Bezout defines analysis to be the method of determining those general rules which assist the understanding in all mathematical investigations, and by Algebra, the instrument which this method employs for accomplishing that end. Euler's Alg. 2d edit. London. p. 3.

nique analitique" of Lagrange, and the " Mécanique céleste" of Laplace, which, doubtless, at present, form the limit to which human ingenuity and mental power have been extended. By having elementary works composed with reference to the higher books, and leading naturally to them, much of the strength of an enterprising scientific man will be spared, and reserved for some other valuable purpose, which would, otherwise, be exhausted and mispent upon treatises less fitted to guide him safely to his ultimate object.

We now proceed to notice particularly the volumes before us. It is important to remark, that the arithmetic will be of little advantage to any, who are determined not to take the trouble of thinking, and who have nothing of the spirit of enquiry and investigation. At the same time the book is calculated to awaken and cultivate this spirit. The author first occupies himself with some general remarks on the different kinds of magnitude or quantity, on the proper idea of number, and on the natural mode of forming numbers. From the observation, that there are no limits to the extention of numbers, he takes occasion to explain in a very luminous manner, the construction of the numerical nomenclature, by which numbers to any extent, are expressed by a small number of terms. This, again, gives him opportunity to illustrate the written numeration, and the fundamental law of it, " that a removal of one place towards the left, increases the value of a figure ten times." This method of expressing all numbers with ten characters, by giving them at once an absolute and a local value, is extremely ingenious, and appears to have originated in India.* (Laplace, Syst. du Monde, p. 368.) It is from this construction, that the extreme facility of all our arithmetical calculations is derived, by which the modern system of arithmetic is rendered so much superior to the ancient. We shall have some idea of the merit and difficulty of the invention, by considering that it escaped the genius of Archimedes and Apollonius, two of the greatest men of antiquity. There is a verbal difference between enumeration as given by Lacroix and other French writers, and as stated in English and American arithmetical books. In both methods of reading numbers, the seventh figure from right to left, is denominated millions. In the English method, the 13th figure is billions, the 19th trillions, and every addition of six places, receives a new denomination, while in

the French method, the 10th figure is the place of billions, the 13th of trillions, and each succeeding addition of three places, gives a new denomination.*

Fractions are introduced immediately after division, and are very naturally considered as deriving their origin from imperfect divisions. He explains the changes which a fraction receives from operations performed upon its numerator and denominator; and in this way collects a few principles upon which the whole theory of fractions is made to depend. Indeed, these principles might be reduced to one, were it not that the subject would thus be rendered unnecessarily and unprofitably abstract.

A circumstance over which the greatest part of authors have passed too superficially, is, the application of the definitions of multiplication and division relative to whole numbers, to fractions. These definitions applied to whole numbers, comprise only the most simple cases of the operations which they express, while as applied to fractions, the terms multiplication and division have a general acceptation, in which new cases are comprised, connected with the first only by simple analogies. Our author has, therefore, given new definitions of multiplication and division, which appear a little abstract before reflection, but which are applicable to all possible cases of these operations. By this instance, also, the student is taught in a striking manner, the signification of the term generalization in mathematical and philosophical writings.

The complication which the diversity of denominators introduces into operations by common fractions, leads naturally to the invention of decimal fractions, which removes this complication. Decimal fractions are therefore, here introduced in the order of invention. The student is prepared by his own experience of the inconveniences attached in practice to the use of vulgar fractions, to seize completely the advantages of the decimal system, although this system generally gives only approximate instead of rigorous values. This disadvantage, however, of the decimal sys-

* The French method of estimating numbers is adopted in the Art. Arithmetic of the Edinb. Encyc. as being less complicated than the English method. As the difference between the two methods is only in the higher denominations, which seldom occur, the difference for practical purposes will not be great.

tem is almost nothing in practice, as the approximations may be carried to any required degree of exactness.

In the translation, reduction and the rules for compound numbers are written anew, and adapted to our system of weights and measures. This was necessary, because the original was prepared with reference to the new French metrical system, the construction of which is strictly decimals. Proportion is illustrated with admirable clearness, and is freed from several distinctions made in the common books, which serve only to embarrass the learner. The rule for compound proportion, as generally given, is applicable only to questions containing five terms, whereas Lacroix has investigated a rule which extends to questions containing any number of terms.

With all its merits, we think this treatise of arithmetic is not without its defects. It would be more useful for practical, and not less so, for theoretical purposes, if it contained a few more applications to classes of questions arising from the social and commercial relations of man. The translation is in this respect somewhat less valuable than the original, as this contains a short article on the application of arithmetic to banking and commerce. But even the original is not sufficient. We know very well, that all these questions belong to proportion or fractions, and cause no possible difficulty to one theoretically acquainted with the subject, but practical men are guided very mechanically by rules, and are immediately alarmed and embarrassed if they are obliged to depart in the least from acquired habits. At page 65, on American money, the statute of the Old Congress of Aug. 1786, is referred to, instead of the Act of April 1792, by which the mint of the United States was established on its present foundation. The note upon the same page, is almost entirely wrong, as will appear from a comparison of it with what follows, which is taken from the statute above referred to, and which furnishes a part of the materials, of which such a note ought to be composed. By this act, Eagles, half-Eagles, and quarter-Eagles in gold; dollars, half-dollars, quarter-dollars, dimes and half-dimes in silver; and cents and half-cents in copper; are the established coins. The standard for gold coins only, is eleven parts fine, and one part allay. The standard for silver coins, is, 1485 parts fine to 179 parts allay. The allay in the gold coins is a mixture of silver and

copper, not exceeding one half silver; in the silver coins, the allay is entirely copper. The weight of fine gold in the Eagle is 247.5; of standard gold, 270. The weight of fine silver in the dollar, is, 371.25 grains; of standard silver, 416 grains. All coins, inferior to the Eagle, and dollar, contain a quantity of pure metal and allay, proportional to their denominations. The proportional value of gold to silver is established by law to be in the ratio of 15 to 1.

In page 78, the franc is valued at $0.1796, which does not agree with its value as obtained from the value of the Napoleon, or piece of 40 francs given in the table on the last page, and neither of these values agrees with that obtained from the five franc piece, which was declared by an act of Congress of April 1816, founded, we understand, on the report of the Assayer of the mint, and which is now in force, to be 93 cents and 3 mills.

The last 50 pages of the original, are omitted by the translator, as they consist mostly of tables for converting the old French measures into the new, and the reverse; and of other subjects of local reference. Two articles in this part, however, ought certainly to have been retained; one on the decomposition of a number into its factors, and the other, on the nature and summation of a numerical continued fraction. The former is often of great practical utility, and the latter is indispensable to the completeness, and even to the consistency of the course, because in Legendre's geometry, which forms the fourth volume of it, in investigating the approximated ratio of the diagonal to the side of a square, the student is required to sum up a continued fraction, for which no means are furnished him.

As the summation of a continued fraction is necessary to the course, and not to be found in any of our arithmetical books, we shall give a translation of M. Lacroix's article on the subject, for the benefit of those readers, who may not have a copy of the original at hand.

"When we are conducted by a calculation to a fraction whose numerator and denominator are pretty large, and have no common factor, we seek approximate values of this fraction, which are expressed by more simple numbers, with a view to form a more exact idea of it.

If we have for example the fractional number $\frac{1103}{887}$, we obtain, at first, the whole number, and there results 1 and

$\frac{216}{887}$. Now, to form a more simple idea of the fraction $\frac{216}{887}$, we endeavour to compare it with a part of unity, that we may consider but one term, and for this we divide the two terms by 216; we find 1 for the quotient of the numerator, and $4\frac{23}{216}$ for that of the denominator; this last quotient, which is contained between 4 and 5, shews also that the fraction $\frac{216}{887}$ is between $\frac{1}{4}$ and $\frac{1}{5}$. By stopping at this point, we see that the second approximate value of the expression $\frac{1103}{887}$ is 1 and $\frac{1}{4}$, or $\frac{5}{4}$. But this value is too great, for the true value would be equal to 1 plus 1 divided by 4 and $\frac{23}{216}$, which is written thus: $1\cfrac{1}{4\frac{23}{216}}$.

To form an exact idea of the expression $1\cfrac{1}{4\frac{23}{216}}$, it is necessary to consider it as indicating the quotient of the whole number 1 divided by the whole number 4 accompanied by the fraction $\frac{23}{216}$.

If we divide the two terms of $\frac{23}{216}$ by 23, the quotient will be $\cfrac{1}{9\frac{9}{23}}$; neglecting the $\frac{9}{23}$ which accompany the whole number 9, there will be $\frac{1}{9}$ only instead of $\frac{23}{216}$, and consequently, $1\cfrac{1}{4\frac{1}{9}}$ will a third approximate value of $\frac{1103}{887}$, a value which will be too small, since 9 being less than the true quotient of 216 by 23, the fraction $\frac{1}{9}$ will be greater than that which ought to accompany 4, and consequently the division $4\frac{1}{9}$ will be greater than the exact division $4\frac{23}{216}$, and the quotient $\cfrac{1}{4\frac{1}{9}}$ smaller than the true quotient.

By reducing the whole number 4 with the fraction which accompanies it, and performing the division according to the process of Art. 80, we obtain $\frac{9}{37}$; and we have 1 and $\frac{9}{37}$ or $\frac{46}{37}$ for the third approximate value of $\frac{1103}{887}$.

The exact expression of this value being $1\cfrac{1}{4\cfrac{1}{9\frac{9}{23}}}$, if we divide the two terms of $\frac{9}{23}$ by 9, we shall have $1\cfrac{1}{4\cfrac{1}{9\cfrac{1}{2\frac{5}{9}}}}$; neglecting the fraction $\frac{5}{9}$, there will remain $1\cfrac{1}{4\cfrac{1}{9\frac{1}{2}}}$, a value too great; for the fraction $\frac{1}{2}$ being greater than $\cfrac{1}{2\frac{5}{9}}$, whose place it occupies, will form, by being joined with 9,

a denominator too great, the fraction joined to 4 will consequently be too small, and the last denominator being too small, will render the last fraction too great.

By reducing, at first, $9\frac{1}{2}$ to a fraction, we have $\frac{19}{2}$; $\frac{1}{9\frac{1}{2}}$ will be then $\frac{2}{19}$, and the approximate value will become $1\cfrac{1}{4\frac{2}{19}}$; now $\cfrac{1}{4\frac{2}{19}}$ gives $\frac{19}{78}$, which joined to unity becomes $1\frac{19}{78}$, or $\frac{97}{78}$ for a fourth approximate value of $\frac{1103}{887}$.

Resuming the expression, $1\cfrac{1}{4\cfrac{1}{9\cfrac{1}{2\frac{5}{9}}}}$, we divide the two terms of the last fraction $\frac{5}{9}$ by 5, and obtain $1\cfrac{1}{1\frac{4}{5}}$, and

$$1\cfrac{1}{4\cfrac{1}{9\cfrac{1}{2\cfrac{1}{1\frac{4}{5}}}}}$$

; neglecting the fraction $\frac{4}{5}$, there will remain

$$1\cfrac{1}{4\cfrac{1}{9\cfrac{1}{2\frac{1}{1}}}}$$

; and we see as above, that this value is smaller than the true value.

The fraction $\cfrac{1}{2\frac{1}{1}}$ reduces itself to $\frac{1}{3}$; and since the preceding $\cfrac{1}{9\frac{1}{3}}$ gives $\frac{3}{28}$, the next preceding becomes $\cfrac{1}{4\frac{3}{28}}$, equal to $\frac{28}{115}$; so that the fifth approximate value is $1\frac{28}{115}$ or $\frac{143}{115}$.

Dividing, finally, by 4 the two terms of the fraction $\frac{4}{5}$ which was neglected above, we have for a quotient $\cfrac{1}{1\frac{1}{4}}$; and by suppressing the fraction $\frac{1}{4}$, we obtain the new value

$$1\cfrac{1}{4\cfrac{1}{9\cfrac{1}{2\cfrac{1}{1\frac{1}{1}}}}}$$

, greater than the true value. If we reduce, successively, all the denominators to a fraction, to obtain the simple fraction which it represents, we shall find $1\frac{47}{193}$ or $\frac{240}{193}$. By restoring the fraction $\frac{1}{4}$ to the side of the last denominator, we form the expression

$$1\cfrac{1}{4\cfrac{1}{9\cfrac{1}{2\cfrac{1}{1\cfrac{1}{1\frac{1}{4}}}}}}$$

, which being reduced as the preceding, reproduces the fractional number $\frac{1103}{887}$.

We may pursue the same process with any other fraction, and obtain a series of approximate values, alternately greater and less than its true value, if it is a fraction properly so called, or alternately less and greater, if as in the preceding example, the numerator exceeds the denominator.

The developments which I have now found for the expression $\frac{1103}{887}$ are called *continued fractions*, which may be defined in general thus :—*Fractions whose denominator is composed of a whole number and a fraction, which fraction has for a denominator also a whole number and a fraction,&c.*"

Of the introduction to the elements of Algebra taken from Euler, much need not be said. The original treatise of Euler especially with Lagrange's additions, is very extensive, and is certainly one of the most luminous and complete treatises that have ever been written, and of course, any selection from it must partake of the merits of the original work. But as is always the case in such selections, the parts selected are not perfectly adjusted to each other, which gives rise to some abrupt transitions. It forms no necessary part of the course, and may be read previous to Lacroix's Algebra, or may be passed over without any other inconvenience than the necessity of dwelling somewhat longer upon Lacroix. It is, it must be confessed, read with more facility than Lacroix's, and is exceedingly well adapted to primary instruction. But we do not know that any point is explained by Euler which is neglected by Lacroix, much less that any one is better explained. The selections here published, comprise the greatest part of Euler's first volume, and are made from a translation published in England.

The Algebra of Lacroix next claims our attention. He introduces his subject by some preliminary remarks upon the transition from Arithmetic to Algebra, which are followed by observations on its nature and object. Several problems involving an equation are first solved entirely by common language, for which algebraic signs are immediately substituted, and the solution performed by means of them. In this way, the reason of the employment of Algebraic signs is from the first clearly made known, their utility and necessity become manifest, and Algebra is shewn to be a branch of universal language, differing from common language principally in the circumstances, that every sign has an invariable meaning, that it is of a far more ab-

stract character, and that it is infinitely more concise, which properties enable the calculator by a glance of the eye, to comprehend all the conditions, relations and consequences of the most complicated and bewildering enunciation. The learner is here, likewise, instructed in translating an enunciation from common to algebraic language, and vice versâ; and in the nature and use of *general formulas* as independent of particular problems, and as merely *indicating* operations to be performed upon numbers in order to find the numerical results belonging to any problem whose solution is required. This, if the student has vigour of mind sufficient to grasp the idea in all its extent, will forever remove the difficulties arising from the general and abstract nature of algebraic expressions, a difficulty which must be fully overcome by him, before his path in this science will be luminous, or even in a considerable degree free from embarrassment.

Our author next introduces the resolution of equations of the first degree with one in known quantity. We have heard him complained of for this early introduction of equations, but when we reflect, that equations are involved in one shape or another, even in the most simple arithmetical calculations, and that his early discussion of them gives rise to some remarks which throw much light upon the succeeding parts, we cannot consider his arrangement erroneous. Considering addition, subtraction, multiplication and division only as operations *analogous* to the like arithmetical operations, and presenting them in a point of view highly interesting, he has removed all the difficulty relative to the doctrine of plus and minus quantities, which is generally to beginners, so much a source of embarrassment and discouragement. In the investigation of the greatest common divisor of two expressions, his method will be found far more complete than those in common treatises, as must be evident to every one who will take the trouble of a comparison. In particular, the artifice of expunging from one of the expressions, any factor or factors not entering into all the terms of the other expression; and on the other hand, of introducing into one of the expressions, a factor not contained in all the terms of the other, is illustrated from the theory of multiplication in a very elementary manner. These improvements in the investigation of the greatest common divisor are the more valua-

ble, on account of its connexion with the solution of equations of the higher degrees.

After disposing of fractions, he resumes equations of the first degree, and discusses those cases in which two or more unknown quantities enter into them. This he does, by resolving several problems at great length, and seizing every opportunity that is presented, in the progress of the solution, to give important theoretical and practical instruction. In this way, he takes occasion to explain the nature of insulated negative quantities, (what was shewn before under the simple rules, having related to negative quantities combined in expressions with positive,) and he has demonstrated, a priori, that they follow the same rules as other quantities. This was necessary, as the theory of negative quantities is, at the same time, one of the most important and difficult of Algebra, and ought, therefore, to be established by rigorous reasonings. Indeed, it appears from the history of Algebraic science, that this theory especially in what relates to negative solutions of problems, was but little understood before the time of De Cartes.*(Essais,258.)

The signification of the phrase *infinite quantities* in mathematics, is deduced from a fractional expression in which the numerator remains constant, while the denominator is continually diminished. The ultimate point towards which this diminution advances is zero, whence the expression $\frac{m}{o}$ is naturally the symbol of infinity; and mathematical infinity is a negative idea, and signifies merely the exclusion of all *limit* either in smallness or greatness. We arrive at the idea, therefore, by a series of negations, and infinity is that of which we affirm the limits cannot be attained by any conceivable magnitude whatever it may be.* The

* Assez souvent, says Lacroix, on a substitué le mot *indefini* au mot *infini*, croyant par là éluder les difficultes que faisait naitre ce dernier ; mais je ne vois en cela qu'une faute d' expression ; car l' *indefini* peut avoir des limites, mais on en fait abstraction pour le moment, tandis que l'infini est nécessairement ce dont on affirme que les limites ne peuvent être attaintes par quelque grandeur concevable que ce soit.'' Traité du calc. Diff. &c. Pref. xix.

Another way more plain but less rigorous, of obtaining the idea of infinity given above, is this ; any quantity m divided by a quantity much smaller than itself, gives a quotient much greater than itself, whence since the values of fractions whose numerators are constant, are inversely as their denominators, m divided by a quantity *very small*, will give a quotient *very* large ; therefore, m divided by zero, gives a quotient greater than any finite quantity.

symbol of an indeterminate quantity is $\frac{o}{o}$, and an elementary method is given, of ascertaining the true value of expressions which appear to be indeterminate. The general methods of finding the true value of such expressions, belongs to the higher algebra. Equations of the first degree are concluded by an investigation and application of general formulas for their solution, after the manner of Bezaut.

The extraction of the square root both of entire and fractional numbers, is next introduced, as this operation is necessary and preparatory to the solution of equations of the second degree. The exposition of the method is founded on the composition and analysis of the formula $a^2+2ab+b^2$, in which a represents the tens and b the units of the number. From this proposition of the theory of numbers, that "every prime number, which will divide the product of two numbers, will necessarily divide one of these numbers," it is shewn to result, that "entire numbers, except such, as are perfect squares, admit of no assignable root, either among whole numbers or fractions."* Hence, the extraction of the square root, applied to numbers not perfect squares. makes us acquainted with a new kind of numbers, which, having no *common measure* with unity, or no relation to it that can be expressed by whole numbers or fractions, are termed *incommensurable* or *irrational.* A method is here given of approximating the square root of numbers not perfect squares, and also, the square root of fractions the terms of which are not both perfect squares.

Proceeding to the solution of equations of the second degree, he shews the reason why the double sign $\pm$ is considered as affecting the square root of every quantity, and explains what is to be understood when we say, that the square root of a negative quantity is imaginary. His general formula for resolving complete equations of this degree, is, $x^2+px=q$, in which p and q denote known quantities, either positive or negative. After treating of the properties of negative solutions, and examing in what cases problems of the second degree become absurd, he gives an in-

* The reasoning here given, expressed in a summary way is this; entire numbers not perfect squares, it is obvious, can have no *entire root*; therefore, if they have a root, it must be among irreducible fractions; but irreducible fractions when squared, form still irreducible fractions which cannot become entire numbers

genious and elegant demonstration of the doctrine, that there are two solutions to every equation of the second degree. This demonstration, also, contains the germ of the general theory of equations of any degree.

The binomial theorem, is rigorously demonstrated, and its extensive applications well pointed out. This was especially necessary with respect to a formula, that serves as a foundation for so great a number of important investigations. In the "elements," the demonstration is limited to the case of the theorem, in which the exponent of the binomial is a positive whole number; but in the "Supplement," it is extended to the cases, in which the exponent is fractional or negative. In his demonstration, instead of concluding the general expression of the theorem from the observation of some particular powers of a binomial, a method of proceeding which is defective because of the limited number of powers we are able to observe, he investigates the law which connects a preceding power with that which succeeds it, and this law thus connecting a series of powers of unlimited extent, makes all the remote results depend upon the first, which may be immediately and strictly verified. It is in this way that he has obtained the general expression of the terms of this celebrated formula of Sir I. Newton.

After employing the binomial formula to explain the extraction of the cube and other roots both of numbers and of literal quantities, he treats of "equations with two terms," and gives a specimen of analytical refinement not often to be found in elementary treatises. On "Radical Expressions," there is nothing very noticeable, except his remarks on some peculiar cases which occur in the calculus of these quantities, in which two or three dark points are illustrated from the theory of equations with two terms.

The necessary limits within which we are confined, will not permit us to enter into a particular examination of the "general Theory of Equations," and of "Equations exceeding the first degree." If justice were done to the subject, the discussion must necessarily be long, and might perhaps be tedious and uninteresting. We know not how a better selection of elementary methods for obtaining universal resolutions of equations, could have been made. The style, also, in which they are presented, corresponds with

the present state of mathematical science. They are taken principally from the writings of Newton, Clairaut, Euler and Lagrange. On the "resolution of Numerical Equations" by approximation, Sir I. Newton's "method by successive substitutions" is given with the improvements of Lagrange, by which it is simplified, and the degree of approximation at each step made known. Several other principles are introduced from Lagrange's "resolutions des Equations Numériques," which in some measure prepare the student to engage in the study of that very complete and profound treatise.

After equations, the leading principles in the theory of proportion and equidifference, are demonstrated with an ease and conciseness, which must surprise those who are acquainted only with the tedious method of Euclid and other ancient mathematicians. As proportion and equidifference may be expressed by equations with perfect convenience, we think it would be well to supercede our present parade of proportions by substituting the corresponding equations. Such a form of expression would be more simple as well as precise, and would at the same time, give greater uniformity to our methods. Progression both by differences and by quotients, is made to depend immediately upon the preceding principles, and general formulas are investigated to determine any particular term, the sum of any number of terms, &c. in each of them. Some elementary principles of the general theory of series, are likewise derived from the doctrine of progressions

In his exposition of logarithms, M. Lacroix has adopted the view of them presented first by Euler in his "Introduction à l'analyse de l'infini," and of which the elementary part is developed with great care in the first volume of his algebra. In this view, all numbers are considered as produced by a constant number raised to a variable power; and logarithms are the exponents of the powers to which a constant number must be raised, in order that all possible numbers may be successively deduced from it. The celebrated Lagrange contemplates logarithms as derived from the same origin. To the objection, that these views are not sufficiently elementary, Euler long since answered, by treating the subject without any other preparatory knowledge than the arithmetic of powers. The treatise is con-

cluded by formulas for calculating the interest of money and annuities. These formulas are derived from progressions and logarithms, and form a useful application of algebra to the practical pursuits of life.

Our opinion of M. Lacroix's work, will be sufficiently collected from the preceding observations. The translation is performed with ability and fidelity. A few particulars, however, concerning both the original and translation merit notice. The demonstration of the binomial formula, we think, ought to be more elementary, as an understanding of it is at present too difficult for many such students, as are to be found in the American colleges. At least, the theory of permutations and combinations on which it is founded, ought to be more fully developed. In art. 42, there is an error both in the original and translation. "Recollecting," it is said, that a product has the same sign as the multiplicand when the multiplier has the sign +, and that *it* has in the contrary case the sign —, &c." It has: what has? the construction says the product has. But that appears otherwise, since — by — produces +. And the construction allows neither multiplicand nor multiplier to be the legitimate antecedent of *it*. But we conclude for the sake of truth, that the latter ought to be understood by the pronoun *it*; and that the reading ought to be thus; recollecting that when a product has the same sign as the multiplicand, the multiplier has the sign +; and that in the contrary case, it has the sign — &c.* In page 114 the author appears to us to render a very plain thing, almost obscure. The letter x, in this case, is taken independently of either of the signs + or —; being used independently of any relations expressed by those signs. It is an independent symbol of the value of the unknown quantity sought, whether this quantity is affected with the sign + or —. There are instances of incorrect translation at pp. 18, 23, 54.........At p. 37 near the top, the last clause, " and retaining the accents, which belonged to the coefficients;" does not express the meaning of the original. Several valuable explanatory notes are added by the translator. In that given at p. 95, doubtless by inadvertence, the parentheses which ought to indicate the multiplications between the factors, are omitted. There is not a uniformi-

* The above remark was suggested by a valuable scientific friend.

ty in translating several technical words ; compare pp. 24, 38, 58, 62, 67, contents p. 7. The list of errata given at the end, might be considerably extended. There are several references that appear useless, pp. 68, 107. The translation is very free from French idioms. The worst we have noticed is at p. 7. Complaints have been made of the length of the problem commencing at p. 69. But when the importance and extensive application of the doctrine of the changes of the signs corresponding to the different directions of the couriers, and the difficult points illustrated in the course of the solution, are considered, the student can hardly conclude that he has been unprofitably occupied. A want of examples for practical exercise, has been objected to the work. On this point, M. Lacroix follows the course of the French and other continental mathematicians, which is, to give an extensive investigation of principles, and supply all necessary remarks ; and to depend principally on the instructor to see that the student is thoroughly versed in the practical application of them.

METAPHYSICS.

Art. XIV.—On Infinites.

By Isaac Orr, *one of the Instructors in the Asylum for the Deaf and Dumb at Hartford.*

TO PROFESSOR SILLIMAN.

Dear Sir,

On account of the diversity of opinion on the subject of infinites, it is certainly highly desirable, that some person competent to the undertaking should treat of them fully and systematically, as far as the human mind is capable of investigating them. The analogy existing between the various kinds of infinity would aid very much in their illustration. By the succeeding remarks, however, more humble in their aim, and yet perhaps bolder than the result will justify, it is intended merely to point out some, at least apparently, erroneous opinions that are prevalent, part of which

are frequent, part common, and part perhaps universal. It is not intended to say absolutely, that they are wholly, or even partially erroneous; but to place the arguments that bear against them in such a light, as to give them, if possible, their full efficiency. The opinions alluded to are the following.

We cannot comprehend infinity: our ideas about it are merely negative: we can tell what it is not, but we cannot tell what it is. Mathematical infinites and infinitesimals, although extremely great or extremely small, are still in all cases measurable by a finite mind. Numerical infinity is impossible; for any collection of units, however great, is with intuitive certainty numerable. The universe must be finite in extent, because its parts are finite, and finite parts cannot constitute infinity. The work of creation cannot have been eternal for the same reason, that it would imply an infinite series of units, or of finite parts, which is impossible. Matter and finite spirits cannot have been eternal, either in a combined or elementary state, because their eternity necessarily implies their independent existence, and precludes the need of a Deity. All systems, therefore, that assert or admit the eternity of matter, are atheistical.

When it is said that we cannot comprehend infinity, it seems difficult to tell what is meant by the assertion. If it is meant that we cannot encompass it in thought, or number its parts, there can be no doubt in the case; for from the nature of infinity and of the human mind, this is of course impossible. And if it is meant that we cannot know all the truth respecting it. this may be readily granted, for it is the case with regard to almost every subject of investigation with which we are acquainted. That we can know something about it is seldom disputed; and with infinity, as with other subjects, we may go patiently to work, and examine it as far as the utmost limit to which our minds can penetrate.

Mr. Locke says, "We have no idea of infinite space;" and afterwards, "We have no *positive* idea of infinite space, duration or number." It appears that he attempted to prove the less, because he was apprehensive that the arguments which he had adduced respecting the greater would not be satisfactory to all. Mr. Locke built well on his own foundation, or rather the foundation which had stood for ages

before him. It is true, that we can have no idea of infinite space, if it is necessary that such an idea should be a sensible species, a phantasm, or even an intelligible species floating in the mind. But this doctrine, notwithstanding the vast authority by which it was sustained, is now almost entirely exploded: and after the main structure has been overthrown, it seems as if no one need hesitate to cast the fragments out of the way. According to the new and probably correct doctrine of ideas, we may be said to have an idea or ideas of any thing respecting which we can with certainty make either a positive or negative assertion. Our ideas of a complex subject may be incomplete, and even some of them erroneous: but by this circumstance the title of those that are correct to the name of ideas, cannot be forfeited. If we are listening to the description of a mineral, and are told that it is not like a diamond, we then have a negative idea respecting it: we know what it is not, yet from this information we do not know what it is. And if we are told that it is not like an emerald, this gives us only an additional negative idea; and so all the account that can be given respecting it, which merely enables us to know that it differs from other things, while it gives us no insight into its real qualities, is entirely negative. But it is worthy of remark, that the very name *mineral*, under which the account is given, conveys to us a positive idea. The assertions that it is not like a diamond or an emerald, are not in their widest sense strictly true. We perceive that like the diamond and the emerald it is solid and visible; and these perceptions are positive. Again, if we are told that it is not opaque, the expression, though given in the negative form, conveys to us a positive idea: we see at once that it is translucent. Translucency or opacity being the property of all minerals whatever, the terms, as well as the meanings which they properly convey, like the terms of an algebraic equation, may be either negative or positive, that circumstance being entirely dependent on the situation which they hold in the sentence. It is needless to add another of the numerous instances that occur of a similar description. In all cases where the negative ideas are restricted to a certain number, and all but one are given; that is, if we know that a thing, circumstance, or property, is comparable or identical with one of a number of other things, circumstances or

properties, and are told that it is unlike all but one of them, a positive idea of the subject is then inevitable. It ought to be kept in mind that positive and negative are entirely distinguishable from complete and incomplete, competent and defective. Though in many cases one will involve the other, yet the line of distinction cannot be mistaken. If the rule for positive and negative ideas, deduced from the above remarks, is not the right one, it is obvious that no fixed and general rule can be given; but the subject is left entirely to the caprice or convenience of the individual who discusses it. If it is the right one, then we have a positive idea or ideas of a subject, when we know to the least extent any of its intrinsic properties; and merely negative ideas, when we know only that it is diverse from several things specified, and yet, as far as our minds are concerned, subject to all the boundless variety of real and possible forms and conditions which are not specified. It would seem, then, that our idea of infinite space is as positive as it well can be; for we see with intuitive certainty that it is wholly unlike all other real existences that are possible. Mr. Locke takes some pains to prove, that infinite space is a real existence. But a writer in a modern, and justly celebrated work, asserts that God alone is infinite, and that space is a mere nonentity; not having in itself even finite existence, but possessing the potentiality of admitting existence. He asserts at the same time, that mind with its affections has no relation to space. To assert that the inevitable perception of extent without limitation, which is present in almost every mind, is solely and entirely the perception of an attribute of the Deity, and then virtually to declare that mind is incapable of such an attribute, evinces a versatility and variety in the application of terms, which, however much it may amuse the imagination, and exercise the intellect, communicates a needless obscurity to the style and to the argument. The same writer admits that wherever there is matter there is space; that God can make his works infinite; and yet without proving or even supposing that he has not made them so, he virtually declares, that if these works are not infinite, infinite space is a mere nonentity, existing only in conception. Notwithstanding the seeming incongruity of this language when taken in its usual acceptation, it appears probable enough, that he had the same idea of

what has been heretofore termed infinite space, as existed in the mind of Mr Locke; and indeed, as it seems impossible should not exist in every mind that has turned itself to the subject, and is capable of taking a single step in the course of an argument. If there is any use in a circumlocution, there can be no objections to calling it, the infinite potentiality of admitting existence; or it may be called nonentity, though a mere child in philosophy would be sure that it is infinite nonentity. Besides, it seems too much like dooming the term *nonentity* to penance for its past deficiency, and decreeing, that whereas it has heretofore conveyed from mind to mind the idea of a nothing of no extent, it shall hereafter convey the idea of an infinite nothing.

Mr. Locke remarks, that by repeated additions of the idea of finite space we come at the idea of infinity of space, but not at the idea of space infinite. This indeed looks a little like supposing that infinite space has a substratum.

Dormitat aliquando etiam bonus Homerus. The human mind usually in its first steps towards the idea of infinite space, annexes finite to finite space several times successively; but it does not appear certain that this is always the case. However far the idea of specific finite space is carried, the mere perception that there is space beyond it, by no means implies the perception of infinite space, for the limits of finite space are in all cases also beyond it. This process appears to be merely opening the eyes of the intellect. The ultimate process is to set up an imaginary limit without any reference at all to the position or intervening distance, and to substitute it for all supposable limits whatever; and the mind then perceives with instant intuition that all such limits are wholly an absurdity.

The error with regard to mathematical infinity and infinitesimals, exists principally in those minds which are not accustomed to look beyond the steps of a demonstration, as they are laid down before them. President Day in his excellent system of algebra has given the following definition of infinites and of infinitesimals. "Infinite in the highest and most proper sense, is that which is so great that nothing can be added, or supposed to be added. A mathematical quantity is said to be infinite, when it is supposed to be increased beyond any determinate limits. When a quantity is diminished till it becomes less than any determinate

quantity, it is called an infinitesimal." These definitions are perfectly correct, taking in the two last "any determinate limit," and "any determinate quantities," for all determinate limits, and all determinate quantities whatever. The idea of mathematical infinity can be clearly obtained only from space and duration. In abstract number if we add millions to millions for ever so long a period, we see with certainty that the numbers thus obtained are in all cases finite. And if we suppose an abstract number infinite in the highest sense, that is, so great that nothing can be added to it, or supposed to be added, the mind sees at once that the supposition is an absurdity. It even appears while we deal only with abstract numbers, as if there could not be such a number really infinite, even in a mathematical sense; that is, so great, that though it is capable of increase, it is notwithstanding incalculable by every finite mind. But if we suppose a line infinite in one direction, and terminating in the other at a given point, this line may properly be said to be mathematically infinite: for though it is evidently capable of increase, yet it is measureable by no finite mind. In the same sense past duration has been infinite: it is capable of increase, but the repetition of no finite duration can measure it. But in this sense future duration never will and never can be infinite. The infinity which is usually applied to it is the infinity of a mere abstraction of the mind. We see, it is true, that future duration will never terminate, but we see with equal certainty that it will never arrive at infinity. We will at present take it for granted that the infinite line supposed above, and infinite past duration, may be divided into finite parts. Then however far the idea of the finite part which we call unity is extended, we shall have in each case a number mathematically infinite. It is usually said, that we obtain the idea of an infinitesmal by dividing a given space, or numerical unit into a certain number of parts, then into a greater number, and so on, increasing at each step, till the mind is wearied, and then because we see that the number may be still increased, and the quantity of each part diminished, we conclude there may be a part so small that no finite mind can measure it. It is obvious that these steps are exactly analogous to those which are first taken in quest of the idea of infinite space. How the mind draws the conclusion that the

spaces or expressions may be infinitely small when it knows with certainty that their becoming so by this process is wholly impossible, may seem mysterious. But the mystery lies in another step of which perhaps we are not always conscious. We suppose a space between two limits, and substitute it for all measureable spaces whatever. We know that the substitution is perfectly correct. Then the space not being in any case absolutely nothing, and the limits being of no extent, we see with certainty that another separating limit of no extent can be crowded in between them. It would seem as if no judicious mind could feel a conviction of the possibility of a quantity infinitely small merely from the first similar steps of the process : and even with the last additional one the subject remains considerably obscure: for notwithstanding the conditions of the problem, the mind still seizes on the ultimate portions, as measurable by finite quantities. But suppose a fractional expression, the numerator of which is one, and the denominator a series of figures infinitely extended. That the supposition of such a series is admissible, we have already taken for granted. The proof will come hereafter. We should then obviously have the expression for an extent so small that no finite mind could measure it. Taking this supposed extent as in the case above, and placing it between two limits, we see with certainty, that it is not absolutely nothing: and the supposed limits having no extent, we see with the same certainty, that an intervening limit of no extent can be pushed in between them. Here then, after the space is infinitely small, we see that it may still be divided and diminished.

On the subject of an infinite series of units, I am happy to adduce the opinion of the late Professor Fisher, in his own language. "If you say it is metaphysically impossible that the earth should have performed infinite revolutions about the sun, you maintain that there was a certain revolution and a certain point in the orbit, suppose A, at which it must have begun to move. In other words, it is seen by the mind to be impossible, that the earth should have described an arc of a foot before the point A. But the mind does not in fact perceive any such impossibility : on the other hand, it appears just as easy, that the foot which precedes this point should have been described, as

the foot which follows it. However far we push back an idea of the earth's revolving, nothing obliges us to stop, and to say at this point it began to move." It is obvious that each of the revolutions supposed in the above argument, would be a unit. It proves, therefore, the possibility of an infinite series of units. It of course proves also the possibility of an infinite universe, and of an eternal work of creation. But it is by no means the only argument. It is not intended at present to show that the universe is actually infinite or that the work of creation has been eternal; but merely that either supposition involves no absurdity. It is admitted by all that God is every where present, and it will not be denied that wherever he is present, he can create; for to adduce and believe such a denial would at once destroy the idea of his own omnipotence. The conviction then, must be irresistible, that God has the power to make the universe infinite. A concession to this effect is all that is requisite. Suppose that he had made it infinite, and instead of placing the stars in their present order, had arranged them regularly in parallel lines, having a given distance between them, say twenty billions of miles. Take the stars in one of these lines, and the line being infinite, we see with certainty that the number of stars in that line would also be infinite; not in the highest sense, for of such infinity, number is not capable; but so great as to be incalculable by any finite mind. Take all the lines of stars that lie in a single infinite plane, and it is obvious that there will be an infinite number of lines, in each of which an infinite number of stars or units is included. Again, take all the infinite parallel planes, and there are an infinite number of planes or units, each of which contains an infinite number of lines or units, and each of these lines contains also an infinite number of units. Here then, we have the cube of an infinite number. If these expressions appear incoherent to any one, let him for a moment divest his mind entirely of language, and the ideas will be unequivocal, and light as day. Again, it is granted by all, that God is eternal; and also that his power of action has been eternal. It will also certainly be granted, that this power might have been exerted at every period of its existence, or else it was not a power. If it might have been exerted eternally, then eternal creation is no absurdity.

Mr. Fisher observes, when remarking on the possibility of an eternal creation as an effect of Divine power, "If there be any seeming inconsistency in the language *eternal effect*, we may call it an eternal existence dependent on another eternal existence, in such manner, that if the latter had never existed, the former never would. I have sometimes illustrated it to myself in this manner. Suppose a straight rod to begin at the earth and to stretch towards the north. Let it be supposed immoveable, but that all other matter gravitates in lines at right angles to it, and tends to fall away from it. A chain may be hung parallel to this rod, by means of wires placed at moderate distances. It is self-evident, that the chain may be supported to as great a distance as the rod stretches; and therefore if the rod stretches to infinity, it will support a chain of infinite length. The analogy of extension to duration admits this conclusion to be extended with intuitive clearness to the latter." To some it may perhaps appear necessary, that if the agent and the work are coeternal, the volition and the effect must be in all cases contemporaneous. But if the agent has been eternal, and if he has been eternally at work, and if we admit the necessity in every case of a time intervening between the volition and the effect, we see with certainty that the admission involves no difficulty except with regard to the original act. But the supposed original act of a being eternally at work is an absurdity. To those however who still consider it indispensable that the volition and the effect should be coincident with regard to duration, it may be answered, that so they might be. If it be said that the Deity necessarily requires any time in which to perform one of his operations, that time may be expressed by a finite number, or infinitesimal. But to say that he cannot perform an operation in a less time than a given one, is virtually to say that his power is limited. It will doubtless be objected, that if the work of creation has been eternal, then some one portion of the universe must alone have been eternal, and therefore could not have been created. This portion the mind perceives must have been the original one. But the original unit of an eternal series is an absurdity. Besides if such an argument is admissible, it will equally well disprove infinite duration and infinite space. For it is obvious that in past duration, any point whatever may be assumed by a finite mind; but it sees

with certainty that the period between that point and the present is finite. Therefore infinite duration is impossible. From this fallacy, however, it leaps with alacrity, for it perceives with the quickness of instinct, that of such finite quantities however great, eternal duration comprehends an infinity. So of infinite space any two points may be assumed, and therefore space cannot be boundless, because the space between those points is finite. But of such finites, infinite space obviously comprehends an infinity. In order that the line between two points should be infinite, it is necessary that they should be extreme points. But extreme points in infinite space, is a contradiction in terms, and an absurdity. To many minds that discuss infinites, it seems a most mysterious circumstance, that they fall into so many inevitable fallacies, and find arguments of apparently irresistible force set point blank against each other. But it is well worthy of remark, that such fallacies are never incurred, except when we attempt to measure infinites by a finite number of finite quantities ; a mode of proceeding which leaves less ground for wonder at its results, than at the genius that prompted it.

The opinion that the eternity of matter and of finite spirits, necessarily implies an independent existence, is founded on the habit of reasoning from analogy. We have been accustomed to consider the Deity alone possessed of eternal existence, and the supposition that he only has existed eternally, unavoidably implies that he is independent. Hence when we attribute eternity to any other existence, we are apt to conclude, that whereas independence is obviously a necessary concomitant of eternity in the Supreme Being, it must be so of course in the case of all other eternal existences. Eternal creation as supposed above is strictly eternal ; and yet is as perfectly dependent on the Deity as if it were not supposed eternal. Should it be said, that if matter and finite spirits are dependent on the Deity for existence, they cannot have been eternal ; then there was a certain point in duration before which the Deity could not uphold them in existence ; and between the present time and that point the duration is indispensably finite. Therefore during an eternity God had not the power to uphold the world. It is needless to say that this is an absurdity. If we assert that it was necessary for him to create them sometime before their capability of being upheld in existence, then, as stated above, God cannot per-

form his works without a given time to do it. The preceding arguments tend only to show that the universe may be finite or infinite, and that matter and finite spirits, or the work of creation may have been temporal or eternal. The knowledge of what has occurred, and what exists in fact, if it should be ever obtained, depends entirely on a different train of arguments.

With much respect,

your obedient servant,

ISAAC ORR.

Hartford, July 31, 1822.

CHEMISTRY, PHYSICS, &c.

Art. XV.—*Analysis of the Maculureite, or Fluo-Silicate of Magnesia, a new mineral species, from New-Jersey; by* Henry Seybert, *of Philadelphia.*

Read before the American Philosophical Society, on the 17th of May, 1822.

The colour of this mineral is generally wine yellow, sometimes reddish brown, and occasionally presents a greenish hue; reduced to pow r, it is of a pale yellow colour. Its lustre is most frequently vitreous, but some specimens approach nearer to that of wax. In mass it is, for the most part, opaque; small fragments are generally transparent. Its form is irregularly lenticular or spheroidal, but it never occurs regularly crystallized; it exhibits a crystalline structure, and presents two cleavages in opposite directions. I have not been able to obtain the primitive form by mechanical division. The fracture in one direction, is distinctly lamellar, in the opposite, it is less regular. Fragments indeterminate. It scratches fluor spar and glass, and gives sparks abundantly with steel. It occurs imbedded in carbonate of lime, accompanied by carbonate of iron, and occasionally by minute portions of mica. The size of the spheroids varies from that of a pin's head, to several inches in diameter. and they often embrace carbonate of lime and carbonate of iron as nuclei. Its specific gravity varies from 3.157 to 3.225. Before the blowpipe it is infusible

per se; with borax it yields a transparent colourless and vitreous globule.

Analysis, (No. 1.)

A. Three grammes of the pure mineral, in the state of an impalpable powder, were exposed to a red heat, in a platina crucible; after the calcination, the colour of the powder had become a shade darker, and it weighed 2.97 grammes, therefore the moisture, dissipated by calcination, amounts to 0.03 grammes on three grammes, or one per one hundred.

B. The calcined mineral (A) was boiled with nitro muriatic acid, the acid readily acted on it, and converted it into a jelly; the mixture was evaporated to a dry mass, which was treated with water acidulated with muriatic acid, and again moderately evaporated; more water was then added and the solution was filtered, to separate the silica, which, after edulcoration and calcination, weighed 0.91 grammes, on 3 grammes, equivalent to 30.333 per 100. At the close of the calcination, I observed that the upper surface of the crucible was coated with a very minute portion of a white sublimate, but as the matter was very inconsiderable in quantity, I supposed it to be a portion of the silica adhering to the crucible, and therefore deemed it unnecessary to examine it.

C. After the separation of the silica, (B) the liquor was neutralized with caustic potash; it was then treated with the hydro-sulphate of potash, which occasioned a black precipitate; this precipitate, after being well washed, was calcined in a porcelain vessel, to expel the greater part of the sulphur; it was then treated with a little nitric acid and exposed to a strong red heat, in a platina crucible; after this calcination it weighed 0.05 grammes on 3 grammes, or 1.666 per 100; this product, on examination with caustic potash, was found to contain neither manganese nor alumina, and thus proved to be peroxide of iron.

D. The liquor (C) when tested with oxalate of potash, gave no trace of lime.

E. The liquor (C) treated with an excess of caustic potash, gave an abundant flocculent precipitate, which, on exposure to a strong heat, yielded 1.70 grammes of magnesia on 3 grammes, or 56.666 per 100.

From the above analysis we have the following result:—

	Per 100 *Parts.*				
A. Water, -	01.000	containing oxygen			
B. Silica, -	30.333	-	-	-	15.257
C. Peroxide of Iron,	01.666	-	-	-	00.510
E. Magnesia,	56.666	-	-	-	21.935
	89.665				
	100.000				
	10.335	Loss.			

Analysis, (No. 2.)

The great deficiency in the above results, in regard to the 100 parts of mineral employed, rendered it highly probable that an alcali was an essential constituent of this substance. The analysis was then repeated in the following manner:

A. Three grammes of the mineral were finely pulverized and exposed to a red heat; the colour of the powder was not materially altered; the weight, after calcination, was 2.98 grammes, therefore the moisture volatalized, by calcination, was 0.02 grammes on 3 grammes, or 0.666 per 100.

B. The residue of the calcination, (A) was treated as in the preceding analysis, the silica, separated by filtration, after exposure to a red heat, weighed 0.93 grammes on 3 grammes, or 31.0 per 100. The interior of the crucible again presented appearances similar to those stated in the first analysis.

C. The per oxide of iron obtained from the liquor (B,) by the hydro-sulphat of ammonia, weighed 0.09 grammes or 3 grammes, or 3.0 per 100.

D. The liquor (C,) was treated with an excess of lime water, the precipitate produced was very abundant; after being perfectly edulcorated and strongly calcined, it gave 1.68 grammes of magnesia on 3 grammes, or 56.00 per 100.

E. The liquor (D,) which was very voluminous, was concentrated by evaporation, and the lime was precipitated by oxalate of ammonia; the liquor was then filtered, and evap-

orated to a dry saline mass, and the residue was exposed to a red heat. to expel the ammoniacal salts; the fixed salt weighed 0.12 grammes; when treated with water it dissolved, leaving 0.02 grammes of insoluble matter, the filtered solution, on being slowly evaporated, furnished very minute irregular cubes, which, when dried and exposed to the atmosphere, did not deliquesce; they were dissolved in water, and the concentrated solution when treated with the muriate of platina, gave a yellow precipitate of muriate of potash and platina, which was very abundant in proportion to the quantity of salt employed; the alcali thus proved to be potash, and the 0.10 grammes muriate of potash are equivalent to 0.06326 grammes of potash on three grammes, or 2.108 per 100.

The products of this analysis are as follows:—

	Per 100 *Parts.*
A. Water, - -	00.666
B. Silica, - -	31.000
C. Per oxide of Iron,	03.000
D. Magnesia, -	56.000
E. Potash, - -	02.108
	92.774
	100.000
	7.226 Loss.

From the preceding result I was satisfied, that this mineral must contain some other constituent than those which I had detected in it, and on comparing the oxygen of the silica with that of the magnesia, it appeared very probable, that it might be an acid. I searched for boric acid without success. To discover *Fluoric acid*, I proceeded in the following manner, 1st, a portion of the pulverized mineral was heated with an excess of sulphuric acid. and a piece of glass was exposed to the fumes, which were disengaged from the mixture, but it exhibited no signs of corrosion; from this experiment, I could not conclude the absence of fluoric acid, for the silica contained in the mineral would probably have been sufficient to saturate it, and thereby prevent its action on the glass. 2. Three grammes of the pulverized mineral were fused, during thirty minutes, in a

silver crucible with nine grammes of caustic potash ; when the matter had cooled, it was treated with water, and the solution was filtered, the filtered liquor was supersaturated with muriatic acid, the solution was treated with an excess of ammonia, this produced a gelatinous precipitate, which was separated by filtration, the filtered liquor was again treated with a slight excess of muriatic acid, and boiled to expel the carbonic acid, it was then exactly neutralized with ammonia, and treated with lime water, no precipitate was formed, and it was treated with muriate of lime with the same result ; these experiments induced me to believe, that the mineral in question contained *no* fluoric acid, nevertheless, to reduce this fact to greater certitude, I followed precisely the method employed by Professor Klaproth, in his analysis of the Pycnite, viz. three grammes of the substance, reduced to a fine powder, were calcined in a silver crucible, with caustic potash, the silica was separated in the usual way, the liquor was treated with an excess of sub-carbonate of soda, to precipitate the Magnesia ; after filtration the carbonic acid was expelled, from the liquor, by an excess of muriatic acid and subsequent ebullition, it was then exactly neutralized with ammonia, and treated with a solution of pure lime and muriate of lime, without any precipitate having been produced by these reagents.

My attempts to discover Fluoric acid having thus proved fruitless, I determined to direct my attention to the appearances which occurred during the calcination of the silica in the two preceding analyses, the sublimate was very minute in quantity, I prepared some of it from silica obtained, from the mineral, as in the preceding analyses. The silica was dried, at a moderate temperature, and then exposed to a red heat, in a small glass retort ; before the glass was reddened, there passed over a small quantity of water, and a white sublimate appeared on the dome of the retort ; as the heat increased, this sublimate descended into the neck, and lastly, partially, into a receiver adapted to condense it. After the calcination, the retort was removed from the fire, the receiver contained only a very small portion of the sublimate, and a vapour possessing a a very pungent odour, which reddened litmus with great energy : the sublimate incrusting the neck of the retort was colourless, and very acid to the taste, in water it dissolved partially, leaving a flaky residue, the liquor became

strongly acid; when treated with concentrated sulphuric acid it effervesced rapidly, disengaging a pungent gaz, giving rise to dense white vapours in the surrounding atmosphere, its solution in the acid was but partial; this sublimate thus presented properties analogous to the Fluate of silica. To investigate this matter more satisfactorily, I made the following comparative experiments, viz. a portion of the powdered mineral was heated in a glass retort with an excess of sulphuric acid. A mixture of three parts of Fluor spar and one part of silica was then treated in the same manner, the results obtained were precisely similar, a white pungent vapour was disengaged, which condensed, on coming in contact with water, in the form of a white film, and the neck of the retort was incrusted with a white sublimate, which effervesced with sulphuric acid, yielding a gaz which presented the properties of Fluo-silicic acid. These experiments clearly demonstrated, that Fluoric acid was a constituent of the mineral under examination, and I was induced to repeat the experiments above stated according to Professor Klaproth's method, but they were not attended with better success; on examing the silica, obtained in this manner, I observed that it possessed certain properties, which proved that it had retained Fluoric acid; when thrown into water it decrepitated and rendered the liquor acid; with sulphuric acid it effervesced violently, yielding Fluo-silicic acid: the silica, therefore, was intermixed with Fluate of potash and silica, a compound described by Gay Lussac* and Thenard. They state, that potash combines with silica and Fluoric acid, forming a compound which requires six or seven hundred times its weight of water to dissolve it. I also ascertained, that the magnesia, although precipitated by an excess of caustic or carbonated alcali, likewise retained a portion of the Fluoric acid; the cause of my not having obtained any Fluate of Lime from the solutions above mentioned, was thus rendered apparent. I thought to obviate this difficulty in employing Soda instead of Potash, in this manner I succeeded in obtaining some Fluate of Lime, but I ascertained, that the Silica and magnesia still retained a portion of the acid and at length after various experiments, I resorted to the method employed, so successfully, by Professor Berzelius

* Recherches Physico-Chimiques vol. ii. p. 19.

in his analysis of the Pyrophysalite, Pycnite and other Topazes.

Analysis.

A. Three grammes of the pure mineral, finely pulverized and subjected to the action of a red heat, underwent no material alteration, except a diminution of 0.03 gr. on 3 grammes, hence we have 1.0 per. 100 of water.

B. The calcined mineral (A), was exposed to a red heat, during one hour in a platina crucible, with 18 grammes of crystallized sub-carbonate of soda, the mixture did not fuse, when cold its colour was yellowish brown, it was treated with water and the solution was filtered, the filtered liquor was treated with an excess of acetic acid, when treated with carbonate of ammonia it gave no precipitate; it therefore contained no silica: it was again supersaturated with acetic acid and boiled to expel the carbonic acid, the excess of acetic acid was then neutralized with ammonia, and the liquor was treated with muriate of Lime, which occasioned a white, flaky precipitate, possessing the properties of fluate of lime; when calcined, it weighed 0.44 grammes: this result was verified by a second experiment, in which I obtained 0.43 grammes of fluate of lime, and on calcining the mineral a second time, with sub-carbonate of soda, I ascertained that the fluoric acid had been completely separated, the 0.44 grammes of fluate of lime are equivalent to 0.12258 grammes of fluoric acid on 3 grammes, or 4.086 per 100.

C. The residue, on the filter (B), was treated with muriatic acid, which converted it into a jelly; it was evaporated to dryness, then treated with water acidulated with muriatic acid, and again moderately evaporated, more water was added and the solution was filtered, the silica, remaining on the filter, after edulcoration and calcination, weighed 0.98 grammes on 3 grammes, or 32.666 per 100. A second experiment yielded precisely the same quantity of silica.

D. The iron was separated from the liquor (C), as in the 1st Analysis; the per-oxide thus obtained, weighed 0.07 grammes on 3 gr. or 2.333 per 100.

E. The magnesia was precipitated from the liquor (D), with an excess of caustic potash, after a strong calcination it weighed 1.62 grammes on 3 grammes, or 54.00 per 100.

The constituents of this mineral are therefore,

Per 100 *Parts.*

A. Water	01.000	Containing Oxygen.
B. Fluoric Acid	04.086	02.971
C. Silica	32.666	16.430
D. Per Oxide of iron	02.333	00.715
E. Magnesia	54.000	20.903
Analysis(No.2)F.Potash	02.108	00.357
	96.193	
	100.000	
	003.807 Loss.	

In regarding this analysis according to the theory of chemical proportions, this mineral evidently consists of an atom of sub-fluate of Magnesia, combined with three atoms of silicate of Magnesia, the fluate of Potash and silicate of Iron being unessential ingredients, therefore its mineralogical formula will be $M^2\bar{F}l+3MS$.

The subject of the preceding examination, I have been told, was discovered several years ago, by the late Dr. Bruce, near Sparta, in Sussex Co. New-Jersey. When our mineralogists became first acquainted with this substance, it was supposed to be *Sphene:* subsequent investigations led to its being ranked with the *Condrodite*, a mineral discovered in Sweden, and analysed by M. d'Ohsson. The experiments of this gentleman were repeated and verified by Professor Berzeluis the results were as follows: viz.—per 100, Silica 38, Magnesia 54, Oxide of Iron 5.1, Alumina 1.5, Potash 0.86, Manganese a trace, loss 0.54.* From the preceding summary, it is evident that the two substances are essentially different in their chemical composition, though they much resemble each other in their physical characters. Magnesia not having heretofore been found combined with

* Journal of the Royal Institution of G. B. 1822, No. 24.

fluo-silicic acid in a native state; the subject of the preceding experiments, must therefore constitute a *new species* in our mineralogical system, and I propose to call it *Maclureite.* as a mark of my respect and esteem for Mr. Wm. Maclure, to whose efforts we are much indebted for a knowledge of the Mineralogy and Geology of the United States.

ART. XVI.—*Analysis* of the Pyroxene Sahlite, from the vicinity of New-Haven, Conn. By* GEORGE T. BOWEN, *of Providence.*

This mineral is found 2 or 3 miles west of New-Haven, imbedded in green serpentine marble. Its colour is grayish green; the colour of its powder is light gray—its structure is crystalline—easily breaking into rhombic fragments; no distinct crystals, have, however, been observed—its fracture in one direction is foliated, having a vitreous lustre; the cross fracture is uneven and nearly dull—it is translucent at the edges—its hardness is nearly equal to that of augite—it is not magnetic—before the blowpipe it is fusible with difficulty into a dark coloured globule—its specific gravity varies from 3.127 to 3.294.

Analysis.

A. 50 grains of the mineral having been carefully freed from foreign substances, were reduced to an impalpable powder, and exposed during one hour to a high red heat in a platina crucible. The powder after calcination was a shade darker than before, and weighed 49.766 grains. The loss by calcination was therefore .234 grains, or .468 per 100.

B. After calcination the mineral was fused with three times its weight of caustic potash in a silver crucible and kept a red heat during one hour. The mass after fusion was of a grass green colour, which it imparted to the water used to detach it from the crucible. Muriatic acid was added in excess, and the fluid evaporated to dryness. It was then treated with water acidulated with muriatic acid, and the silex separated by the filter; when washed and calcined, it weighed 26.562 grain or 53.124 grains per 100.

* Done in the Laboratory of Yale College.

C. The liquor (B) having been neutralized with ammonia, was treated with the hydrosulphate of ammonia. The black precipitate which was produced after being heated to expel the sulphur, and calcined with nitric acid, weighed 4.192 grains. The alumine separated in the usual manner by the action of caustic potash, weighed 531 grains or 1.062 per 100.

D. The metallic oxides, after the separation of the alumine, weighed 3.645 grains. They were treated with muriate of ammonia to which a small quantity of sugar had been added, in order to separate the manganese. The *peroxide* of iron remaining, was equal to 3.004 grains of *protoxide* in 50 grains, or to 6 008 grains per 100. The protoxide of manganese amounted to .598 grains per 100.

E. Oxalate of potash was then added to the liquor, (D.) The precipitate of oxalate of lime when calcined yielded 11.810 grains of lime, or 23.620 grains per 100.

F. The magnesia was precipitated from the solution, (E) by caustic potash at a boiling heat; when washed and calcined, it weighed 07.250 grains or 14.500 per 100.

The results of this analysis, give as the composition of this mineral per 100 parts:—

A. Water . . .	00.468	containing oxygen.
B. Silica	53.124	. . 26.72
C. Alumine . . .	01.062	. . ———
D. Protoxide of Iron .	06.008	. . 01.36
D. Protoxide of Manganese	00.598	. . ———
E. Lime . . .	23 620	. . 06.63
F. Magnesia . . .	14.500	. . 05.81
	99.380	
	100.000	
	000.620 loss.	

Some mineralogists have considered this substance as Diallage. The preceding experiments, however, sufficiently prove that it is distinct from that mineral. In its external characters, and also in its chemical composition, it corresponds almost exactly with the Pyroxene Sahlite of Sweden. It was discovered a number of years since by Pro-

fessor Silliman, at one of the marble quarries, near New-Haven, and his opinion was that this mineral coincided exactly with the Swedish Sahlite or Malacholite.

Art. XVII.—*Analysis* of a variety of Nephrite, from Smithfield, R. I. By* George T. Bowen, *of Providence.*

This beautiful mineral occurs at Smithfield, imbedded in large nodules in white primitive limestone. Its color is bright apple green—sometimes tinged with blue; the colour of its powder is white—its hardness is equal to that of felspar—its fracture dull and splintery—it is highly translucent, and very difficult to break on account of its great tenacity—before the blowpipe it is infusible. Its specific gravity varies from 2.594 to 2.787.—Its powder when boiled with sulphuric or nitromuriatic acid, is entirely decomposed; the obtained solution yielding an abundant precipitate with Phosphate of soda and ammonia.

Analysis.

A. Fifty grains of the mineral in the powder were exposed, during thirty minutes, to a red heat in a platina crucible; the colour of the powder was not altered. The weight after calcination was 43.250 grains; the moisture dissipated amounted therefore to 6.750 grains in 50 grains, or 13.500 per 100. A piece of the mineral weighing 100 grains was then heated during thirty minutes, without having been reduced to powder. Its green colour disappeared; it lost its translucency, and became of a pure white; its hardness was also much increased as it now scratched glass with facility. The loss of weight amounted to 13.625 grains. The mean of three experiments gave as the loss by calcinations 13.417 grains per 100.

B. One hundred grains of the mineral in powder were fused with 300 grains of caustic potash, in a silver crucible, and kept at a red heat during one hour. The contents of the crucible, when removed from the fire, were of a light green colour.—Muriatic acid was added in excess, and the fluid evaporated to dryness.—The dry mass was then treated with water acidulated with muriatic acid; the silex sep-

* Done in the Laboratory of Yale College.

arated in this manner, when washed and calcined, weighed 44.688 grains.

C. The solution (B), was neutralized with ammonia and treated with the hydrosulphate of ammonia.—The precipitate when ignited and calcined with nitric acid weighed 2.313 grains. When fused with caustic potash, it imparted to it a tinge of green, giving indications of a trace of manganese. The oxide of iron remaining after the action of caustic potash, amounted to 1.747 grains. We have then by difference alumine equal to 0.562 grains.

D. The lime was precipitated from the liquor (C), by the addition of oxalate of potash; when calcined it weighed 4.250 grains.

E. To the remaining solution, (D), after the separation of the lime, caustic potash was added in excess, and the fluid boiled. The magnesia separated by this treatment, when washed and calcined, weighed 34.631 grains.

F. 250 grains of the mineral were introduced into a small porcelain retort which was connected with the mercurial apparatus, and kept at a red heat during one hour. A portion of water distilled over, but no carbonic acid was obtained.

The composition of this mineral is therefore,

Per 100 *Parts.*

A. Water	13.417 containing oxygen	11.17
B. Silica	44.688	22.47
C. Alumine	00.562	———
C. Oxide of Iron	01.747	———
D. Lime	04.250	01.09
E. Magnesia	34.631	13.40
C. Oxide of Manganese	a trace	———
	99.295	
	100.000	
	000.705 Loss.	

On comparing the results of the preceding experiments upon this substance, with the analyses of Nephrite which have been hitherto published, we find a considerable difference in chemical composition; the Smithfield mineral contains a much greater proportion of water, and only a very small quantity of alumine. It differs from Nephrite also in

its inferior hardness, and its infusibility before the blow pipe. It corresponds in other respects with the descriptions of that mineral given in the books, and possesses in a high degree that peculiar tenacity which is so characteristic of the different varieties of Jade.

ART. XVIII.—*Letter from* ROBERT HARE, *M. D. Professor of Chemistry in the University of Pennsylvania, on Alkanet as a substitute for Litmus or Turmeric, &c. also on preparing pure nitrate of silver and on Nitrate of Ammonia for Nitrous Oxide.*

HAVING infused some Alkanet roots in Alcohol, I was surprized at finding the infusion blue instead of red. Recollecting that the Alcohol employed had stood over Pearlash, I tried some of the roots in pure Alcohol, when a red tincture resulted which was rendered blue by a drop of any alkaline solution.

In our chemical compilations I never have met with any account of this habitude. No notice is taken of it under the article Alkanet in Ure's or Aikin's Dictionary. On the contrary the broad assertion is constantly repeated, that acids redden vegetable blues, while alkalies make them green. Yet, as litmus is not converted to a green, and alkanet is made blue by alkalies, it is evident that they not only fail in rendering some blue infusions green, but may render red infusions blue. From the process of manufacturing Litmus we may infer, that its colour is developed by an alkali.

Alkanet roots may be used in place of Litmus, producing the same phenomena in a reversed order. The Alkanet infusion must be made blue by an alkali and restored by an acid, instead of being as in the case of litmus, reddened by an acid and restored by an alkali. Thus as the one is indirectly a test for alkalies, so is the other for acids. In making the infusion of alkanet blue for this purpose, the smallest quantity of alkali should be used, which will accomplish the change, as in that case less acid will be requisite to restore the colour, and thus manifest its presence in any solution to be tested.

I have ascertained that the white crystals which form spontaneously, when silver coin is dissolved in nitric acid, diluted no more than is necessary for the solution to proceed actively, give no trace of copper when redissolved. May not this be a good preliminary step in refining that metal, or for obtaining the nitrat either for lunar caustic or as a test.

I have observed that the strong nitric acid procured from dry nitre, may be saturated with carbonate of ammonia in a retort, and nitrous oxide procured forthwith, by distillation. The salt produced is in the compact form. Instead of metallic air-holders, I make use of bags, such as are made by Pixii at Paris, (such as are called by him Réservoir en Baudruche) passing the gas through water by an apparatus, of which I will send you a drawing as soon as convenient. I find that bags of leather, soaked with boiled linseed oil, will answer to hold the oxide gas.

☞This letter was written a twelve month ago. The facts have since been added in notes to the American edition—Ure's Nicholson's Dictionary.

Art. XIX.—*On the Combustion of Hydrogen in water—being a new application of Hare's Blowpipe.*

For the American Journal of Science.

Mr. Editor,

I have discovered, within three or four months back, that if the flame, produced by the combustion of hydrogen gas, issuing, in combination with oxygen, from the compound blowpipe of Hare, be plunged below the surface of a vessel of water, it continues, notwithstanding its submersion in, and actual contact with, this element, *to burn*, apparently with the same splendour as it does in the common atmosphere. The only difference I am able to discover, is, that when the flame burns in the water, it seems, so to speak, to conglobate its figure ;—whereas in the air, the shape it assumes, is that of a long slender conical pencil.

You will readily believe that the water, which contains within its bosom, a source of heat so abundant, as hydrogen

gas in combustion with oxygen, will have its temperature gapidly elevated. This was the fact; the thermometer rose, in a very short time, in a common half pint tumbler filled with water, say from 50° or 60°, the temperature prevailing at the time, to 170° and upwards.

The reason why the temperature of 212° was not reached, was this. For the purpose of enabling myself to introduce this gaseous flame, into very narrow recesses, I had affixed to the orifice of the blowpipe beforementioned, a silver tube, about an inch or an inch and a half long; which conveyed the gases, *in a mixed state,* to their orifice of ignition. The diameter of the bore of the tube might be, perhaps, one twentieth of an inch. You are aware, then, under these circumstances, that the flame might occasionally recede, into the interior of the tube, to the place of their conjunction. This I found very frequently to occur in the water; but very seldom in the air. In fact, it often required care to introduce the flame, slowly and deliberately, into the water, in order to avoid recession, at its first entrance. The length of time for which the recession could be avoided, or rather was avoided, even under favourable circumstances, was so short, that I did not attempt any experiment, for the purpose of obtaining specific results.

You will imagine, possibly, that with a heat so energetic as the gases in question are known to produce, the water, especially so small a quantity as half a pint, ought to be expected to boil very soon. But, it should be recollected, that the flame was introduced, commonly, very carefully, and to the depth only of about an inch or so. Little vertical communication of heat would take place; the lateral communication, would probably be still less—more especially when we consider that the water in immediate contact with the flame might be expected to be instantaneously converted into steam and ascend to the surface, which was, to all appearance, the fact. Indeed I was not a little surprised to find that, with the same blow-pipe, and under the same circumstances, water was much more heated by the application of it, for a given time to the exterior of a tin vessel than when the same flame was *submersed* in an equal quantity of the same fluid.

To obviate the evil of the recession of the flame, tubes of a fine capillary bore, so small as to prevent recession, are

necessary. With these through which the gases should be driven, with competent pressure, I have no doubt, it would be possible to maintain an uninterrupted ignition, co-existent with the supply of the gases. In my leisure moments, I am preparing to verify this conjecture; but as I shall not probably be able to give you the result in time for your next number, I thought proper to offer to your disposal, the little I have already learnt on the subject.

When a piece of cork or pine wood was applied to the submersed gaseous flame, it gave out a brilliant light, producing a pleasing effect on the spectator; and this phenomenon continued till recession took place, which in some instances might be for a minute or two. Sometimes, however, I observed that the flame was less brilliant than at others. This I attributed either to the imperfect mixture of the gases, or to the excess of oxygen over the hydrogen being less at one time than at another.

Some little experiments I made went to shew, as I thought, that the gases were not perfectly and proportionally mixed. If I caused the submersed flame to burn under an inverted tumbler filled with water, I invariably collected it full of gas, and from a very slight detonation it gave on one or two occasions, I concluded it to be principally, hydrogen.

The metals also were submitted to the submersed flame; but the most I was able to do with them, was to make a small piece of copper wire, say, of $\frac{1}{40}$ of an inch in diameter, red-hot; that is red-hot in the day time. And this was repeated with success several times.

You know that the solder which is used in the fabrication of our common tin ware, is very fusible;—say it fuses at between 300° and 400°, at the highest; and that the iron which forms the basis of the tin, as it is called, melts at 17 or 18 thousand degrees. Now I had the curiosity to make a comparative experiment. I placed on a common smith's forge, a common tin cup, about nine inches deep, and urged around and beneath it, as great a heat as could be obtained from charcoal, (mineral coal not being at hand,) keeping it supplied with a very small quantity of water, without producing any effect, as you will of course believe, towards melting the solder.

Next I took another small tin cup filled with water, and with my blowpipe applied its flame to its external and vertical surface, at an inch or two below the level of the surface of the water it contained; when in a short time, the metal became heated to redness, next to whiteness, and very soon afterwards a perforation appeared, through which the water escaped and the flame entered. Very soon after the application of the flame, the water boiled violently in the immediate vicinity of the heated metallic surface; it became beautifully luminous, and strange as it may seem, the redness and whiteness of the heated metal as mentioned above, was exhibited, not on the exterior surface of the cup only, *but also on the very surface to which the water was contiguous.* The experiment was often repeated, and with great gratification to the beholders. How great then must be the energy of the hydro-oxygen flame, compared with that of a smith's forge!

This flame also burns beneath the surface of alcohol—but this inflammable fluid has not only the inconvenience of burning on its surface, but in consequence, probably, of this inflammability, is more liable than water is, to recession.

I have thus far detailed the little experiments which have lately amused me and my friends. I am not much disposed to indulge in speculation on the applications, which, in the course of the progress of science, may be made of these facts; yet I cannot refrain from observing, that the possibility of effecting the combustion of most substances, with an agent so energetic as the heat evolved by the gases in question, seems to point distinctly among other things, to their employment as a *sub-marine instrument of naval warfare.* From the experiments I have made, (*and these too, with means having no reference whatever*, to the accomplishment of such a purpose,) I am fully satisfied that success may be commanded, and that, in this respect, it will depend on, and be obtained by, the existence of these three circumstances, to wit:—

1st, On causing the mixed gases to issue from fine capillary tubes, of one or two inches long so as to prevent recession.

2d, On expelling them with such velocity as to cause them to effect a considerable displacement of the water, and

create, as it were, an artificial atmosphere of the mixed gases at the same time that they are in combustion.

3d, On supplying to the combustible body, for instance, that part of a ship's bottom, designed to be attacked, a quantity of oxygen gas, which, aided by the intense heat produced by the ignition of the mixed gases, may combine first with the heated copper, converting it into an oxide; and 2d, with the carbonized timber of the ship, converting it into carbonic acid gas.

This object, as I have already stated, I am now devoting my leisure moments to accomplish. And this I expect to do, by combining a great number of capillary streams of the mixt gases into a circular flame, in the centre of which, through other capillary tubes, is transmitted, by means of a tube having no communication with the gases in combustion, a quantity of oxygen gas, adequate to the conversion of metals into oxides, and of charcoal into carbonic acid gas.

How far, in the event of the realization of these views, it might be proper to consider it as an instrument of naval warfare to be employed for the perforation of ship's bottoms, so as to sink them in spite of the efforts of their crews, rather than to use it in conjunction with the torpedo, I shall not now pretend to determine. Certain it is, however, in my opinion, that if the *copper* of a ship's bottom were burnt away, even for a small space, it could not be a difficult matter to contrive to enable a person who should have conducted himself in a diving-boat, underneath an enemy's vessel, to drive, by a moderate yet sudden blow, a nail or spike, to which should be attached a torpedo, into the timber of her bottom, and thus effect the intended destruction. Thus, I apprehend, would be overcome the difficulty heretofore experienced in *attaching* a torpedo, by boring or by upward pressure, since pressure can produce no effect—whereas, a sudden blow would, in all probability, effect the desired attachment; and though the boat would descend by the reaction, this would still be a circumstance of no consequence.

Your most obedient serv't,

THOS. SKIDMORE.

New-York, July 20th, 1822.

Art. XX.—*On the Gales experienced in the Atlantic States of North-America.* By Robert Hare, M. D.

[Read May 14th, 1822, before the Academy of Natural Sciences of Philadelphia, from whose Journal it is copied.]

Of the gales experienced in the Atlantic States of North America, those from the north-east and north-west are by far the most influential: the one remarkable for its dryness; the other for its humidity. During a north-western gale, the sky, unless at its commencement, is always peculiarly clear, and not only water, but ice evaporates rapidly. A north-east wind, when it approaches at all to the nature of a durable gale, is always accompanied by clouds, and usually by rain or snow. The object of the following essay, is to account for this striking diversity of character.

When heat is unequally applied to the lower strata of a non-elastic fluid, the consequent difference of density (resulting from the unequal expansion,) soon causes movements, by which the colder portions change places with the warmer. These being cooled, resume their previous situation, and are again displaced by being again made warmer. Thus, the temperatures reversing the situations, and these reversing the temperatures, a circulation is kept up tending to restore the equilibrium. Precisely similar would be the case with our atmosphere, were it not an elastic fluid, and dependant for its density on pressure, as well as heat. Its temperature would be far more uniform than at present, and all its variations would be gradual. An interchange of position would incessantly take place, between the colder air of the upper regions, and the warmer, and of course lighter air near the earth's surface, where the most heat is evolved from the solar rays. Currents would incessantly set from the poles to the equator below, and from the equator to the poles above. Such currents would constitute our only winds, unless where mountains might produce some deviations. Violent gales, squalls, or tornadoes, would never ensue. Gentler movements would anticipate them. But the actual character of the air with respect to elasticity, is diametrically the opposite of that which we have supposed. It is perfectly elastic. Its density is dependant on pres-

sure, as well as on heat, and it does not follow, that air which may be heated in consequence of its proximity to the earth, will give place to colder air from above. The pressure of the atmosphere varying with the elevation, one stratum of air may be as much rarer by the diminution of pressure consequent to its altitude, as denser by the cold, consequent to its remoteness from the earth, and another may be as much denser by the increased pressure arising from its proximity to the earth, as rarer by being warmer.—Hence when unequally heated, different strata of the atmosphere do not always disturb each other. Yet after a time, the rarefaction in the lower stratum, by greater heat, may so far exceed that in an upper stratum attendant on an inferior degree of pressure, that this stratum may preponderate, and begin to descend. Whenever such a movement commences, it must proceed with increasing velocity; for the pressure on the upper stratum and of course its density and weight, increases as it falls; while the density and weight of the lower stratum, must lessen as it rises. Hence the change is, at times, so much accelerated, as to assume the characteristics of a tornado, squall or hurricane. In like manner may we suppose, the predominant gales of our climate to originate. Dr. Franklin long ago noticed, that north-eastern gales are felt in the south-westernmost portions of the continent first, the time of their commencement being found later, as the place of observation is more to the leeward. This need not surprise us, as it is evident that a current may be produced either by a pressure from behind, or by a hiatus consequent to a removal of a portion of the fluid from before.

The Gulf of Mexico is an immense body of water, warm in the first place by its latitude, in the second place by its being a receptacle of the current produced by the trade winds, which blow in such a direction as to propel the warm water of the torrid zone into it, causing it to overflow and produce the celebrated Gulf Stream, by the ejection to the north-east of the excess received from the south-east. This stream runs away to the northward and eastward of the United States, producing an unnatural warmth in the ocean, as well as an impetus, which, according to Humboldt, is not expended until the current reaches the shores of Africa, and even mixes with the parent flood under the equator.—

The heat of the Gulf Stream enables mariners to ascertain by the thermometer when they have entered it: and in winter this heat, by increasing the solvent power of the adjoining air, loads it with moisture; which, in a subsequent reduction of temperature, is precipitated in those well known fogs, with which the north-eastern portion of our continent, and the neighbouring seas and islands, especially Newfoundland and its banks, are so much infested. An accumulation of warm water in the Gulf of Mexico, adequate thus to influence the ocean at the distance of 2,000 miles, may be expected in its vicinity to have effects proportionally powerful. The air immediately over the Gulf must be heated and surcharged with aqueous particles.— Thus it will become comparatively light; first, because it is comparatively warm, and in the next place because aqueous vapour, being much lighter than the atmospheric air, causes levity by its admixture.

Yet the density arising from inferiority of situation in the stratum of air immediately over the Gulf, compared with that of the volumes of this fluid lying upon the mountainous country beyond it, may to a certain extent, more than make up for the influence of the heat and moisture derived from the Gulf: but violent winds must arise, as soon as these causes predominate over atmospheric pressure, sufficiently to render the cold air of the mountains heavier.

When instead of the air covering a small portion of the mountainous or table land in Spanish America, that of the whole north-eastern portion of the North American continent, is excited into motion, the effects cannot but be equally powerful, and much more permanent. The air of the adjoining country first precipitates itself upon the surface of the Gulf, then that from more distant parts. Thus a current from the north-eastward is produced below. In the interim the air displaced by this current rises, and being confined by the high land of Spanish America, and in part possibly by the trade winds, from passing off in any southerly course, it is of necessity forced to proceed over our part of the continent, forming a south-western current above us. At the same time its capacity for heat being increased by the rarefaction arising from its altitude, much of its moisture will be precipitated, and the lower stratum of the south-western current, mixing with the upper stratum of the cold

north-eastern current below, there must be a prodigious condensation of aqueous vapour. The reason is obvious, why this change is productive only of north-eastern gales; and that we have not northern gales, accompanied by the same phenomena. The course of our mountains is from the north-east to the south-west. Thus no channel is afforded for the air proceeding to the Gulf in any other course, than that north-eastern route which it actually pursues.—The competency of the high lands of Mexico to prevent the escape over them of the moist warm air displaced from the surface of the Gulf, must be evident, from the peculiar dryness of their climate; and the evidence of Humboldt. According to this celebrated traveller, the clouds formed over the Gulf, never rise to a greater height than four thousand nine hundred feet, while the table land for many hundred leagues lies between the elevation of seven and nine thousand feet. Consistently with the chemical laws, which have been experimentally ascertained to operate throughout nature, air which has been in contact with water, can neither be cooled nor rarefied without being rendered cloudy by the precipitation of aqueous particles. It follows then, that the air displaced suddenly from the surface of the Gulf of Mexico, by the influx of cold air from the north-east, never rises higher than the elevation mentioned by Humboldt as infested by clouds. Of course, it never crosses the table land which at the lowest is 2,000 feet higher.

Our north-western winds are produced, no doubt, by the accumulation of warm moist air upon the surface of the ocean, as those from the north-east are by its accumulation on the Gulf of Mexico. But in the case of the Atlantic, there are no mountains to roll back upon our hemisphere the air displaced by the gales which proceed from it, and to impede the impulse thus received, from reaching to the shores of Europe. Our own mountains may procrastinate the flood, and cause it to be more lasting and more terrific when it ensues. The direction of the wind is naturally perpendicular to the boundary of the aquatic region producing it, and to the mountainous barrier which delays the crisis. The course of the North American coast is, like that of its mountains, from north-east to south-west, and the gales in question are always nearly north-west, or at right

angles to the mountains and the coast. The dryness of our north-west wind may be ascribed not only to its coming from the frozen zone, where cold deprives the air of moisture, but likewise to the circumstance above suggested, that the air of the ocean is not like that of the Gulf, forced back over our heads to deluge us with rain.

Other important applications may be made of our chemical knowledge. Thus in the immense capacity of water for heat, especially when vaporized, we see a great magazine of nature provided for mitigating the severity of the winter. To cool this fluid, a much greater quantity of matter must be equally refrigerated. Aqueous vapour is an incessant vehicle for conveying the caloric of warmer climates to colder ones. Mistaking the effects for the cause, snow is considered as producing cold by the ignorant; but it has been proved that as much heat is given out during the condensation of aqueous vapour, as would raise twice its weight of glass to a red heat. Water, in condensing from the æriform state, will raise ten times its bulk one hundred degrees. The quantum of caloric which can raise ten bulks one hundred degrees, would raise one bulk one thousand degrees nearly (or to a red heat visible in the day) and this is independent of the caloric of fluidity, which would increase the result.

Further, the quantum of heat which would raise water to 1000, would elevate an equal bulk of glass to 2000. Hence we may infer, that from every snow, there is received twice as much caloric as would be yielded by a like stratum of red hot powdered glass.

It is thus that the turbulent wave, which at one moment rocks the mariner's sea-boat, on the border of the torrid zone, transformed into a cloud and borne away towards the arctic, soon after supports the sledge or the snow-shoe of an Esquimaux or Greenlander; successively cooling or warming the surrounding media, by absorbing or giving out the material cause of heat.

Art. XXI.—*Notice of Magnetic effects produced* by Dr. Hare's Calorimotor; by* George T. Bowen, *of Providence.*

In Vol. V. p. 352 of the Edin. Phil. Journal, is a description of an electro-magnetic apparatus by Prof. Moll of Utrecht. After having given a description of the instrument, that gentleman observes, "A remarkable feature in the effect of this spiral voltaic apparatus, is the strong adhesion of iron filings to the conductive wire. If the zinc plate be new, or well cleaned, the acid strong, and of course the galvanic process going on with energy, then if iron filings, on a paper, are brought backward and forward, under, and near to the horizontal conductive wire of copper, the iron filings will begin to stand erect as if in the vicinity of a loadstone, and they will even adhere strongly to the copper wire when brought into contact with it." These observations appearing to me to be interesting, I was desirous of seeing what would be the effect produced by presenting iron filings to the wire which connects the opposite poles of the calorimotor of Doct. Hare. The results of the experiments which were performed with this instrument are as follows :—A large copper wire, about one foot in length, was bent in the form of a semi-circle, and its ends connected by means of small vices to the opposite poles of the calorimotor. The instrument was then immersed in the weak acid solution. On bringing a paper containing iron filings into the vicinity of the copper, which had already become hot, the filings began to stand erect, and when brought into contact with the wire they were powerfully attracted by it; adhering to it, and forming a fringe upon its surface. The calorimotor was then raised out of the diluted acid, and it was observed that the filings dropped from the connecting wire, the instant the instrument left the surface of the fluid. This experiment was often repeated; (the size of the connecting wire being varied,) and always with the same results. A platina wire was then bent as in the above experiment, and its ends connected with the opposite poles of the calorimotor. Upon immersing the plates, and bringing the iron filings on a paper, near to, and into contact with the platina, they were powerfully attracted, and

* In the laboratory of Yale College.

adhered to the wire as in the preceding experiment. The instrument being then raised from the diluted acid, the filings fell from the wire. These experiments were repeated, and varied by employing different metals to complete the communication between the two galvanic poles. Wires of iron, copper, brass, lead, zinc, silver, and platina were used; the length of the wire employed being in all cases so regulated, that although it became hot, it was not ignited. In every instance the same magnetic properties were exhibited by the connecting wire; the iron filings being strongly attracted by it, so long as the calorimotor was immersed in the acid solution, and immediately falling from it when the instrument was raised from the fluid.

In Vol. VI. p. 83 of the work above quoted, are detailed some experiments of Prof. Moll, in which he succeeded in imparting magnetism to steel needles by inclosing them in a glass tube, about which was wound a spiral of brass wire, and passing *strong electrical discharges* through the spiral. These experiments were repeated in the following manner: Around a glass tube one quarter of an inch in diameter and four inches in length, was wound spirally, a brass wire, from *left to right*, forming ten spirals. The ends of the wires were then connected with the opposite galvanic poles and a needle, which had been previously ascertained to be free from magnetism was placed within the tube. The instrument was then immersed and remained in the fluid for thirty seconds. Upon examining the needle after the plates had been raised from the acid solution, it was found to have become powerfully magnetic, having a north and south pole; one of which was attracted and the other repelled by the poles of a magnetic needle suspended in the usual manner—they also took up iron filings abundantly. The end of the needle which had been placed nearest to the copper or negative side of the calorimotor had acquired north polarity, while that which had been next to the zinc or positive side had acquired south polarity. This experiment was often repeated, and always with the same results; the end of the needle placed nearest to the copper plates constantly acquiring a north polarity.

One of the needles which had been magnetized in this manner, was again enclosed within the glass tube, its *north pole* being placed next to the copper side of the apparatus. The plates were immersed, and again raised from the fluid.

Upon removing the needle, its poles were found to have been unaffected, the end which had been nearest the copper, still retaining its north polarity. The same needle was again submitted to the galvanic action, its *north pole* being now placed nearest to the *zinc plates* of the instrument; upon examination, its poles were found to be reversed; its south pole which had been placed nearest the *copper* plates, had acquired north polarity, while its *north* pole which was next to the *zinc* plates had acquired south polarity.

A *common magnetic needle* was then enclosed in the tube, its south pole being placed next to the copper side of the apparatus. The plates having been immersed the usual time, the needle was examined. The end which had previously been its south pole, and which was placed next the copper plates, had now acquired north polarity, and in every instance that end of a needle which was connected with the negative side of the calorimotor became its north pole, so long as the spiral brass wire upon the glass tube was wound from *left to right*. I then took the same glass tube and wound a brass wire spirally around it, the spirals however, being now wound from *right to left*. A needle was placed within the tube, and the ends of the spirals connected with the opposite poles of the calorimotor. After the immersion of the plates, the needle was removed from the glass tube and was found to have become magnetic—its *north pole* being that end of the needle which had been connected with *zinc plates* of the instrument, and vice versa. The needle was then again enclosed in the tube and the plates immersed; its acquired south pole being placed in connection with the zinc plates. When examined, its poles were found to be reversed; its former *south* pole which had been connected with the *zinc* plates having now acquired *north polarity;* and in all cases, that end of a needle which was connected with the *zinc* plates of the instrument, acquired *north* polarity, when the spirals about the glass tube were wound from *right to left*.

A steel needle free from magnetism, was then enclosed within a tube of glass four inches long and an eighth of an inch in diameter. This glass tube was then placed within a tube of lead, and the lead tube again enclosed in one of glass, around which was placed a spiral of brass wire, wound from *left to right;* the ends of the spirals being connected with the opposite galvanic poles—The plates were immersed and suffered to remain in the fluid during half a minute

The needle on examination, was found to have become magnetic; its *north pole* being that end of the needle which had been connected with the copper or negative side of the calorimotor. It was again enclosed in the tube as before; the end which had acquired *north* polarity being now placed next to the *zinc* plates. After the immersion of the instrument, the poles of the needle were found to be reversed--the former south pole having now acquired north polarity, and vice versa—the results obtained in this method of operating were always the same; the needle acquiring *north* polarity at the end which was placed nearest the *copper* plates, while the spirals of brass around the glass tube, passed from *left to right.* When the direction of the spirals was changed, and the brass wire wound about the glass tube from *right to left;* then, that end of the needle which was connected with the *zinc* plates always acquired north polarity. Being desirous of ascertaining how long it was necessary the plates should be immersed in order to produce these effects, a needle was inclosed in the tube as in the former experiments, and the plates were then immersed, and *immediately* withdrawn from the fluid. On examination, the needle was found magnetic. Another needle having been placed within the tube, the calorimotor was lowered until the plates had descended into the fluid *one quarter of an inch*, when it was instantly raised. Even in this instance, when the plates had descended only *one quarter of an inch* into the acid solution, and had remained there only *one second*, the needle was found to have become powerfully magnetic, and readily took up iron filings. This experiment was often repeated, and with the same results. The preceding experiments lead to the conclusion, that when a needle is subjected to the galvanic action in the manner above described, it instantly becomes magnetic, and that end of the needle which is connected with the *copper or negative* side of the calorimotor, always acquires *north* polarity, when the turns of the spiral about the glass tube pass from *left to right;* and that end connected with the copper plates always acquires a *south polarity* when the turns of the spiral pass from *right to left.*

From these experiments it appears that the same magnetic effects are produced by Dr. Hare's calorimotor, as by powerful electrical batteries—although he justly considers his instrument, as producing a great flow of caloric almost without electricity.

Art. XXII.—*Fusion and Volatilization of Charcoal, by the* Editor, *with remarks on these experiments and on the Galvanic Instruments of Dr. Hare, by Professor* John Griscom, *of New-York.*

On page 108, of the present volume of this Journal, is mentioned the fusion of charcoal by Professor Hare's Deflagrator. The experiments have been since frequently repeated, with results uniformly the same. A stronger acid has been employed in some of the experiments, and the effects were more rapid and brilliant. The elongation of the charcoal point of the zinc pole was more sudden and extended to a greater length than before. It accumulated in an instant, to the length of a quarter of an inch, and nothing seemed to hinder its acquiring double that length, except the difficulty of holding the points so accurately, as to prevent their striking against one another, and thus detaching the projecting mass of melted charcoal. During the fusion, if the points touch, they adhere. On the copper pole the formation of the crater shaped cavity was equally sudden and rapid. It was also deeper and larger than in the former trials.

Whenever the point of the zinc pole was moved to a new place, the cavity instantly appeared there, and thus the number of cavities was increased at pleasure.

With a Deflagrator of considerable size, and in good order, these experiments are, in fact, extremely easy, and with charcoal well prepared, will never fail in a single instance.* All the results obtained in the former trials were not only confirmed, but were in every respect more striking and pleasing. The surface of the fused charcoal was brilliant, with a metallic and frequently irridescent lustre, and the whole appearance was so changed, as to justify the assertions in the former communication, that the melted substance would never have been suspected, from its appearance, to have had any connection with charcoal. Upon the charcoal on the copper side, there was no appearance of fusion; the crater-shaped cavity was extremely well defined and brilliant, with the proper fibrous and porous ap-

* Prepared charcoal may be boiled afterwards in water, and will still conduct between the poles and melt as above.

pearance of charcoal; every thing indicates that the charcoal is wasted from this pole, and is transferred to the other. It seems to pass, in the state of vapour, to be accumulated or condensed on the positive pole by attraction, and then to undergo a fusion by intense heat. It is nothing new in chemistry that a substance should be vaporised first, and fused afterwards. In this instance, however, it is very possible that the charcoal begins to be melted at the copper pole, but is simultaneously carried by a strong current, or attraction to the zinc pole, and being there detained by the same cause undergoes a new and more complete and accumulating fusion. It does accumulate with surprising rapidity, three seconds being sufficient to produce a decided result.

In order to ascertain whether the air had any agency in producing these effects, the charcoal points were made to communicate in a small glass globe filled with nitrogen.* The light was thought to be even more brilliant than before—the whole globe appeared as if a ball of fire, and the growth of the zinc pole and the fusion of the charcoal, were equally rapid and complete, as in the former instances.

The fused charcoal sinks readily to the bottom of strong sulphuric acid. Common charcoal floats upon rain water, with at least half its volume out—we are therefore, justified in concluding that the specific gravity of charcoal is increased at least four times by fusion, and it also becomes much harder.

Its properties appear to be altered in other respects It becomes so incombustible that when ignited on a red hot iron plate with free access of the air, it remains for a long time unaltered, while pieces of common charcoal placed contiguously, burn rapidly; the fused charcoal eventually wastes away although with extreme slowness, but without the ordinary appearances of combustion, and leaves a small porous residuum of a yellowish gray colour.

It will occur to every reader, that this combustion ought to be performed in close vessels, in order to ascertain whether the product is any thing else than carbonic acid. This trial has been made, the product was nothing but carbonic acid, and therefore we are authorised to say that the fusion evolves no new form of matter, metallic or otherwise—and

* It was prepared by phosphorus over mercury, and stood 17 hours over fused muriate of lime.

that the fused substance is nothing else than carbon in an extremely condensed state; with a specific gravity superior to that of the Anthracite, equal to that of the heaviest Plumbago, and in some degree approximating towards that of the diamond.

The experiment upon which this conclusion was founded, was as follows. Several pieces of the fused charcoal were placed on a small fragment of brick; this was floated in a dish of mercury, and the whole was covered with a small bell glass filled with oxygen gas, obtained over mercury. A burning lens of one foot in diameter and eighteen inches focus, at noon, with a bright sky, (Aug. 29) was made to throw the concentrated rays of the sun, upon the melted charcoal. There was no appearance of combustion, that could be distinguished by the eye, in the bright light of the focus, but, the substance wasted very slowly away, and at length disappeared *leaving no residuum.* The gas, examined in the usual way, gave carbonic acid, mixed with an excess of oxygen gas, which, after the carbonic acid was removed, sustained combustion as it usually does when pure. The heat of the lens had been so intense as to fuse and vitrify the surface of the brick support.

Strong sulphuric acid boiled upon the fused charcoal produces no effect, while with the common charcoal (as it is well known) it is decomposed. The strongest nitric acid in the cold does not affect the melted substance, and even with the aid of a boiling heat, the effect is only slight, and ceases immediately when the heat is withdrawn.

The most interesting of these experiments have been repeated in the presence of Bishop Brownell,* and of Professor Griscom who were well satisfied with the results.

Many specimens of the melted charcoal have been submitted to the inspection of Dr. Hare, who is of opinion that they have undergone a true fusion. This gentleman has also so far repeated the experiments mentioned in the former communication, as to be entirely satisfied of their correctness.

* Formerly Professor of Chemistry in Union College, Schenectady.

Dr. Hare's Calorimotor.

Since the publication of our last number, we have through the kindness of Dr. Hare, obtained this fine instrument, constructed under the direction of the inventor, on a large scale, and in the most perfect manner. We cannot now do any thing more than to say that we find all Dr. Hare's statements fully confirmed.

The facilities which this instrument affords for exhibiting the new and interesting phenomena of magnetism, as produced by Galvanic Instruments, are, we believe, unequalled, particularly in imparting a very powerful magnetic virtue to needles and in causing Iron filings to be taken up readily by wires and strips of all sorts of metals—whether Iron* form a part of the connection or not. We have also been much struck by the permanency of the action of the Calorimotor. The same diluted acid continues to ignite large wires for many weeks in succession, and with slight additions of fresh acid to the fluid, the full effects are at any time easily renewed.

Extract of a letter from Prof. John Griscom, *dated August* 26, 1821, *to the Editor.*

It gives me pleasure to acknowledge that the experiments which, in company with Bishop Brownell, I had the pleasure of witnessing in the laboratory of your college on the 8th inst. went to confirm in the most satisfactory manner, the statement made in the last number of the Am. Journal relative to the power and operation of Dr. Hare's Galvanic Instruments. The rapidity with which the Calorimotor causes the ignition and even fusion of an iron wire some inches in length, and as thick as a goose quill, and the beautifully variegated coruscations of the burning hydrogen kindled by the ignited wire, and the play of the flame on the surface of the liquid after the plates are raised out of the trough, rendered this experiment at once, one of the finest exhibitions that can be made to a class. It is surpassed by nothing but the overpowering brilliancy of the Deflagrator. The effect of this instrument upon two pieces

* See the annexed paper.

Erratum in Professor Griscom's remarks on the Deflagrator, &c.
The top line of p. 366, should be the bottom line of p. 364.

leaving no doubt upon the mind of either of us who witnessed for the first time the operation of this new machine, that the charcoal was not only *fused* but *volatilized;* at least the piece that was connected with the negative pole of the battery. No sooner had the ignition completely taken effect than it was discovered on stopping the action, that instead of a point on the end of the negative charcoal, a cavity or crater of considerable extent had been formed, the edges of which were pointed or jagged. The piece attached to the positive pole on the contrary was increased lengthwise by a cylindrical protuberance, which, when the operation was protracted, grew thicker at the extremity, acquiring an irregular knob, the surface of which was compact, smooth and glossy, resembling not a little in appearance, the surface of hematitic iron ore. The extent of this projection corresponded with the depth of the cavity in the other piece, so as to leave no room for doubt that the thoroughly ignited matter of the negative piece had been transferred by the power of the electro-calorific current to the positive charcoal; and the appearance of the surface, especially when viewed with a magnifier, indicated the *fusion* of the transferred portion. There was, it is true, no *direct* evidence of liquifaction; and it is, I conceive, *possible* that the carbonaceous matter may have been volatilized, and again condensed, without that intermediate change, as in the case of many other solid substances by heat. But, however that may be, the phenomenon, as it respects the charcoal, is different from any thing that has heretofore been published, and it furnishes an additional and striking instance of the power of the voltaic current, and of the superior efficacy and convenience of Dr. Hare's instruments. The entire absence of insulation between the adjacent pair of plates, and the great facility with which their immersions and emersions can be effected, will doubtless give this ingenious modification of the galvanic apparatus a decided superiority over every other. The fluid employed in the experiments above mentioned, had, I think you informed me, remained in the troughs several weeks or months. The new deflagrator, described by Dr. Hare in the last No. of the Journal, which I had an opportunity of seeing at the college in Providence, is still more convenient. In that, the plates remain fixed,

of well prepared and pointed charcoal was truly interesting, while the troughs are raised and lowered by levers which are easily moved by placing the foot on a treadle.

ART. XXIII.—**Additional facts respecting the Condrodite and its identity with the Sparta mineral.* (*Maclureite of Seybert, Brucite of Cleaveland,*) *in a letter addressed to the Editor, dated Philadelphia, August* 26, 1822.

SIR,

SINCE my communication concerning the *Maclureite* was transmitted to you, I observed, in the Annales des Mines,† a memoir by the late Professor Haüy on the Condrodite. By crystallographical investigation he identified that substance with the mineral found near Sparta, N. Jersey; he states, that Berzelius arrived at the same determination by Analysis, and that he considered it a *Silicate of Magnesia.* From the above statement, it was evident to me, that some error existed with regard to the composition of these substances, because the experiments, related in my paper concerning the Maclureite, unequivocally prove the presence of fluoric acid in the mineral found in New-Jersey. As the celebrated Swedish Professor announced the chemical indetity of these substances, without his having detected Fluoric Acid,‡ I was induced to procure some of the mineral from Finland, and obtained a small quantity of it. The specimen was brought from Sweden by Mr. William Maclure; it was imbeded in a gangue of Carbonate of Lime, associated with blue Spinelle, and a greenish mineral resembling Pargasite; from these substances it was, as much as possible, separated by mechanical means. To free it entirely from the Carbonate of Lime it was boiled with Acetic Acid, the residue, after this treatment, weighed 1.20 grammes, it was calcined at a red heat, during one hour, in a platina crucible, with six times its weight of crystallized sub-carbonate of Soda, the matter after calcination was treated with

* Received too late for insertion with Mr. Seybert's Analogies.—*Ed.*

† Annales des Mines, Tome, C. p. 527. et sequen.

‡ See Journal of Royal Institution of G. B. for 1822. No. 24.

water, and the solution was filtered to separate the insoluble residue; Acetic Acid in excess was added to the filtered liquor; by means of Ammonia, it proved to have retained no Silica; the solution was freed from Carbonic Acid by supersaturation with Acetic Acid and subsequent ebullition, the excess of Acetic Acid was neutralized with Ammonia, and the solution was treated with Muriate of Lime; this occasioned a white floculent precipitate, which, when heated with concentrated Sulphuric Acid, disengaged vapours, having the odour of Fluoric Acid, and they corroded glass with energy; therefore this precipitate was Fluate of Lime. It was out of my power to estimate the quantity of Fluoric Acid contained in the mineral, owing to the small quantity I had at my disposal, more especially as it was intimately intermixed with blue Spinell and Pargasite. From the preceding facts I do not doubt, if the mineral from Finland be again examined, it will prove to be a Fluo-Silicate of Magnesia, and that the two substances in question must, as such, be hereafter ranked in our Mineralogical systems.

I submit this letter for publication in the next number of your interesting Journal.

And am, very respectfully,

Your obedient servant,

H. SEYBERT.

Art. XXIV.—*Obituary.*

PROFESSOR FISHER.

Perhaps most of our readers are apprized of the fact,—that Professor Fisher was among the number of those, who perished in the wreck of the Albion, on the morning of the 22d of April last.

Soon after the news of the death of Professor Fisher was confirmed, an Eulogy embracing the principal circumstances in his life and character, was delivered in the College Chapel, by Professor Kingsley: and the parts of the following account which are marked by inverted commas, are taken from that performance.

"ALEXANDER METCALF FISHER, late Professor of Mathematics and Natural Philosophy in Yale College, was born in Franklin, Massachusetts, in the year 1794, July 22; the oldest child of his parents, who still live to mourn, with their remaining children, his untimely death. Of his childhood and early youth, it may be sufficient to state, that he soon discovered an aptitude for learning, and a strong desire for a public education,—a disposition which his parents very wisely determined to foster and indulge. After completing the preparatory course of study, he entered Yale College in the year 1809. Here he was immediately distinguished for his sobriety, his diligence, his scrupulous attention to all the regulations of the College, and his rapid advances in the studies of his class. So early did his real character as a scholar unfold itself, that in the very first term of his college life, he took a place among his companions, where he saw no superior,—a station which he never relinquished."

"It deserves, likewise, to be here mentioned, that he early gave evidence of an independence of mind, a disregard of the opinion and practices of others where they at all interfered with his own views of right,—as honourable as it is rare, and which, perhaps, more than even his native sagacity and penetration, contributed to his success as a scholar. If he wished to secure the approbation and esteem of those around him, he knew well, it was not to be sought by connivance at faults or base compliance with corrupt solicitations, but to be commanded by a resolute performance of his duties as a member of the institution, and a strict obedience to the dictates of his own conscience."

"At every exercise, whether recitation or lecture, he was always present, always attentive, and always prepared."

"Yet in this exact and punctilious attention to his duties as a student, he was never, it is believed, suspected by any one of his companions to be influenced by unworthy motives:—the honours of College were his right; every one admitted his deserts; he looked for no favours, and practiced no artifice. His preeminence in scholarship caused no relaxation of his efforts. His industry was unremitted; and his attachment to knowledge seemed strengthened as his acquisitions increased."

"While an undergraduate, he excelled in every part of collegiate study, but was, perhaps, most distinguished in the branch of pure and mixed mathematics; for progress in which he was peculiarly qualified by the rapidity of his perceptions, and habits of close, and long continued attention; which enabled him, with apparent ease, to trace quantities in their remotest relations, and disentangle the most complicated theorems. That he would be eminent in this department of science, was then easily foreseen; if his future situation in life should be such, as to allow him an opportunity to cultivate his favourite studies. He received his Bachelor's degree, in the year 1813, and left the College with a reputation, which few at the same period of their literary life, have attained; a reputation created by nothing casual or adventitious, and which did not exceed his merits.

"The two years which followed, he spent partly in his native town in attending to moral and metaphysical science, and partly in commencing a theological education at the Seminary in Andover. In the year 1815, he was elected to the office of Tutor in Yale College, a place for which he was known to possess the highest qualifications, and in which no doubt was entertained he would contribute, in the full proportion of his talents, to the usefulness and reputation of the seminary. Nor were the expectations which the friends indulged of his success, in any respect disappointed. He at once engaged in all the duties of his station, both as an instructor and a governor, with a readiness, an ability, and a devotion to his object, which soon satisfied those, who had an opportunity to observe his progress, that great as was his capacity for the acquisition of knowledge, his talent for communicating it to others, and for distinction in the whole routine of academic life, would not be less conspicuous.

"In the year 1817, he was elected Adjunct Professor of Mathematics and Natural Philosophy in the College, and in 1819, entered upon the full duties of his office. From the moment he was designated to this place, all his views, wishes and exertions seemed directed to the single object of qualifying himself for the entire discharge of its obligations. His ambition looked to no other station of usefulness and distinction; he well knew his own peculiar talents, and that here was the station where he could exert himself the most successfully and honorably. From the time of his gradua-

tion, though his studies had been chiefly directed to theological and moral inquiries, yet he never relinquished his attention to his favorite mathematics, nor much abated his attachment and zeal for natural science. The consequence was, that though young for so responsible an office as the Professorship of Mathematics and Natural Philosophy in Yale College, yet his attainments were universally thought by the friends of the institution to be adequate to the place: and those who were best acquainted with his habits of study and his actual acquirements, were the most confident of his success.

"As his prospects for life had now changed, his studies were accommodated to his new situation; without, however excluding those subjects of moral science, which had received so much of his attention, and whose importance and value he had so justly estimated. He immediately entered, with all the ardor of youth, and the zeal inspired by a favorite pursuit, upon a plan of mathematical and philosophical study, embracing every topic of these enlarged sciences, in their widest extent. With what success he prosecuted his design, is well known to most of this audience. In the time which elapsed from his election to his new office, to his departure for Europe, he had examined and digested the writings of the principal philosophers of Britain, tracing every discovery, theory, and illustration to its source; and had read, with the same attention, many of the most valuable publications of the mathematicians and philosophers of France. He had, in the same time, prepared a full course of lectures in Natural Philosophy, both theoretical and experimental, which for copiousness, clearness, and exact adaptation to the purposes of instruction, equalled the highest expectations of his friends. Having thus far accomplished his original design, he resolved on an excursion to Europe, not so much for the sake of making new acquisitions in science,—for the knowledge of European philosophers is found in their books,—as to visit the places of public instruction, and examine by actual inspection the modes of communicating knowledge in the foreign universities,—to form an acquaintance with men who were distinguished in his own department,—and to obtain such information as might enable him more fully to aid in raising the scientific character of his country, and in promoting

the usefulness and prosperity of his college, to the interests of which he was entirely devoted. Every preparation was made which was thought necessary to secure the attainment of his object;—and after the fullest inquiries and taking the best advice, he embarked at New York, for Liverpool, on board the Albion packet; where, to use his own language, in the last communication received from him, " every thing seemed to promise a quick, safe and agreeable passage."—On the first of April last, he left his country, full of animation and zeal, and attended with the ardent wishes of his friends for the success of his enterprize."

It appears from a comparison of the several accounts which have been published of the loss of the Albion,—that, for the first twenty days after leaving New York, the weather was moderate and favorable; and that about one o'clock on the afternoon of Sunday the 21st, the ship made the south of Ireland. Soon after a gale commenced, which blew the remainder of the day with great violence. About half past 8 o'clock in the evening, the Albion shipped a heavy sea, which threw her on her beam ends, and took the mainmast by the deck, the head of the mizenmast, and fore topmast, and swept the decks clear of every thing, including boats, compasses, &c. and stove in all the hatches, staterooms and bulwarks in the cabin, which was nearly filled with water. At the same time, six of the crew, and one cabin passenger, Mr. Converse of N. Y. were swept overboard. The axes being lost, no means remained of clearing the wreck, and the ship was unmanageable. About three o'clock, the ship struck on a reef of rocks about one hundred yards from the main land. This, as afterwards appeared, was in Courtmacsherry-Bay, about three miles west of the old head of Kinsale. In about half an hour the ship went to pieces; and all the cabin passengers except Mr. W. Everhart of Chester, Pennsylvania, were lost. It is understood that Prof. Fisher, as well as some others, was considerably injured when the masts were carried away;—and at the time the other passengers went on deck, after the captain had informed them of their imminent danger, he remained below in his birth. Whether he afterwards came up, and what were the particular circumstances of his death, is unknown.

The character of Prof. Fisher is thus drawn by the author of the Eulogy.

"The character of Professor Fisher, such as it appeared to me from familiar acquaintance and long observation, I should fear to delineate in any other place than this,—where there are so many who can testify to the justness of the description, and shield me from the charge of fanciful and extravagant panegyric. But here I do not hesitate to exhibit it as it was,—in perfect confidence, that what I say will receive the fullest attestation from those who hear me.

"I have already alluded to the quickness with which he apprehended the most remote truths: but rapid and almost intuitive as were his perceptions, no one could be more free from the fault of precipitate judgment. Caution, no less than activity, constituted a prominent feature of his mind; and on whatever subject he had formed an opinion, seldom could a difficulty be suggested, which he had not foreseen, or an objection which he was not prepared to remove. To this union of a cautious and quick judgment, of ready decision and prudent wariness, no doubt the scheme of study, which he early adopted, and to which he constantly adhered, very greatly contributed. Whatever book he read, it was the subject of which it treated, that received his first and principal attention. He examined the statements and reasonings of an author, less to know his peculiar views and manner of unfolding them, than to aid his own investigations, and obtain materials for thought and reflection. Hence, while he was familiar with books within the range of his studies, and minutely acquainted with the opinions and reasonings of others, he preserved his independence of mind. The operations of his understanding were very little liable to be embarrassed with conflicting opinions, adopted at different times, with equal confidence. He was enslaved to no system, was facinated with no work on account of its antiquity or its novelty,—he brought the merits of a writer to the standard of his own intellect,—and his judgment, though soon formed, he seldom found reason to vary.

"With a mind so unshackled, he was in a high degree prepared for original investigation: and here perhaps was to be found his most distinguishing characteristic. Whatever subject he examined, he was almost certain to find

some new method of supporting or illustrating truths already known, or by the aid of discoveries already made, to advance to some new and more remote conclusion.

"As might be expected, he was confident in his own opinions,—but not impatient of contradiction; he was always candid and ingenuous,—asserted his own views without dogmatism, and defended them without obstinacy. His deportment, on all occasions, was unassuming and modest, marked with no pretension, and the farthest removed from ostentation or display. If in the society of his friends, or in more enlarged circles, he conversed on subjects connected with his peculiar pursuits, these were never topics of his own selecting, but introduced by others. His studious and retired habits may have given him among those who imperfectly knew him, the appearance of reserve; yet among his familiar acquaintance, his disposition seemed frank and open, his affections warm, and he discovered those qualities which are usually thought to prepare, in a high degree, those who possess them, for social and domestic life.

"As to the extent of his scientific and literary attainments, the proofs he has given of eminence in mathematical and physical knowledge, leave no room in this department for doubt or hesitation.. Whoever has watched the progress of his studies, or the course of his instruction, or has examined his communications to the public, will need no further evidence of talents and acquisitions in his own peculiar province, of the first order. But his researches, as before intimated, were not confined to mathematics and physics. The philosophy of the mind was likewise his favorite study. He was familiarly acquainted with the writings of the most distinguished metaphysicians, and had examined with the closest scrutiny, their various reasonings, speculations and theories. If his knowledge of the exact sciences qualified him to pursue with uncommon advantage the evanescent and less easily defined objects of intellectual philosophy,—his knowledge of the laws of the human mind, its capacity, and the proper region for the exertion of its powers, was no less useful in directing and regulating his physical inquiries. This rare union of two kinds of knowledge so different, and the want of which union has so often been attended with injury to both, was considered by the friends of Professor Fisher as constituting one of his chief excellencies,

and affording the surest promise of future usefulness and distinction. Besides his acquirements in the branches of knowledge already mentioned, and which formed, no doubt, his favourite subjects of research, he ever continued to cultivate a taste for classical learning, was familiar with the literature of England and France, and, indeed, there are few topics of miscellnaeous knowledge, to which, with his great industry and exact method in the employment of time, he had not been able to give a portion of his attention.

"What he was as an officer of this College, is best known to his brethren of the immediate government and instruction;—and to them particularly, I would appeal for the truth of the declaration,—that here he was a model of integrity and faithfulness, which it would be well for all in similar stations to imitate, but which few can hope to excel. Who ever knew him neglect or decline any duty? The interests of the institution, were with him, the primary object of attention and regard. To know those who were under his government and instruction, and to be known by them; to encourage the studious, and to expose the negligent and the vicious; to unite firmness and discretion, a due regard to the circumstances of individuals, with an impartial execution of the laws, was his constant aim, and formed the distinguishing traits of his academic character.

"I have only to add,—that to his other qualities, was united a deep sense of religious obligation. All his conduct seemed marked with an exact and unvarying conscientiousness. Few have manifested a higher reverence for the divine law, or failed less in their obedience to the precepts of the gospel.

"Such is an outline of the character of him we have lost. He was one whose talents and acquisitions we deservedly held in the highest estimation; one who was an ornament to this College, and seemed destined by his zeal and activity, and the boldness and success with which he entered on the most arduous courses of scientific research, to be an honor to his age and country. But he is gone: and it becomes us to submit without murmuring, to this severe, and to us mysterious dispensation, of a righteous providence. But though resignation is our duty, neither the principles of true philosophy, nor the precepts of christianity, forbid us to unite with his numerous friends, and, especially, with his

parents and other relatives, in mourning his early departure. The best feelings of our natures, the kindest affection of our hearts, are expressed in our tears; and the Saviour himself, wept at the death of his friend. Long will it be, before the event we this day deplore, shall be recollected within these walls without the deepest sorrow;—or the name of him we have lost, be here mentioned without awakening the tenderest sympathy."

The articles furnished by Professor Fisher for this Journal are the following.

Essay on Musical Temperament. Vol. I.

Remarks on Dr. Enfield's Institutes of Natural Philosophy. Vol. III.

On some recent Improvements in the construction of the Printing Press, &c. Vol. III.

On Maxima and Minima of Functions of two variable Quantities. Vol. V.

Among articles furnished by him for other works, the following may be mentioned—

Solutions of various Mathematical Questions, under the signature X, in the "American Monthly Magazine," commenced in New York, in the year 1817. Among these, the solution of a Prize Question, proposed by Professor Adrain, as to *the most advantageous position of the sail of a windmill, when the ratio of the velocities of the sail and wind is given,* is deserving of particular notice.

Solutions of various questions under the signature of Nov-Anglus, in Leybourn's Mathematical Repository.

Observations on the Comet of 1819, *and calculation of its orbit,* in the fourth volume of the Memoirs of the American Academy of Arts and Sciences.

I cannot dismiss the subject of the preceding notice, without adding my own testimony to the merits of my lamented friend and coadjutor, Professor Fisher. It is natural to dwell, with fondness, upon the character of a departed friend, and the more so, when a sudden and tragical death

has separated him from us. But, after making every proper deduction on this account, I can truly say, that Mr. Fisher was the most extraordinary man of his years, whom I have ever known. Acquisitions, equal to his, at the age of twenty eight, I have never seen; nor a more vigorous and acute intellect at any age. His moral characteristics—founded on the elevated principles of the Christian religion, which he fully embraced—were distinguished for unsullied purity and inflexible integrity. To his extraordinaty scientific attainments, he added the finish of classical and polite literature, derived from the best ancient as well as modern sources; his elegant taste embraced the fine arts in their extent and variety, and he was satisfied with nothing, even in the decorum and accommodations of private life, which was not adapted to the same elevated standard. In the management of this Journal—for the support and prosperity of which he ever manifested a warm zeal—he was an important auxiliary; and no other opinion was ever thought necessary, when he had once given his, (which was often asked,) especially on subjects of mathematical and physical science. Perhaps, it is not improper to add, that, at a period, when, from the failure of health, it appeared probable that the Journal must either be relinquished, or pass into other hands, Professor Fisher, was the man who would have been depended upon to assume that responsibility.

His projected scientific and literary tour, excited in my mind the strongest interest—it commanded such efforts as I could make for the promotion of his object, and I looked forward with high raised hopes and expectations, to the period of his return, when, I doubted not, he would bring back with him, the richest harvest of knowledge, unalloyed by any thing that could give pain to the most affectionate and to the purest of his friends. But it pleased the Almighty to dash him upon the rocks, and to overwhelm him in the ocean, at the moment when Europe, so long and so ardently desired, had just broke on his view!

A few of his personal friends in this place, have procured an excellent portrait of him to be painted by an eminent artist,* and to be hung in the room which was lately the scene of his labours and instructions. An engraving† of it is prefixed to this number. EDITOR.

* Mr Sam. F. B. Morse. † By Mr. S. S. Jocelyn

INTELLIGENCE AND MISCELLANIES.

I. *Foreign Literature and Science.*

1. *Analysis of an Ore of Silver.*—An Analysis of Antimoniated Sulphuret of Silver, (Red Silver,) has recently been made in the laboratory of M. Berzelius at Stockholm, by P. A. de Bonsdorf, Adjunct Professor of Chemistry, at Abo. According to Klaproth, this mineral contains :—

Silver	60
Antimony	19
Sulphur	17
Oxygen	4
	100

Proust makes it contain, 3 per cent. of Oxide of Iron, 3 of Sand, and 3 of Water,—6 loss.

The process of Bonsdorf appears to have been carefully conducted, and his result is—

			Oxygen.	Sulphur.
Silver	58.94	which would	4.36	8.768
Antimony	22.84	require	4.19	8.423
Sulphur	16.61			
Earthy substance	.30			
Loss	1.31			
	100.			

In reflecting on this result, (says the author,) we see that the given quantities of silver and antimony are susceptible of combining with nearly the same quantity of sulphur. We know that the sulphuret of silver contains 2 atoms of sulphur and 1 atom of silver, and that the sulphuret of Antimony is composed of 3 atoms of sulphur and 1 of antimony. Consequently, the chemical constitution of the antimoniated sulphuret of silver will be expressed by $2SbS^3 + 3AgS^2$ and the calculated results will become—

Silver	58.98
Antimony	23.46
Sulphur	17.56
	100.

The mineral examined, was the Red Silver of Andreasberg. *Ann. de Chem. Jan.* 1822.

2. *Solubility of Magnesia.*—Very different degrees of solubility have been assigned by different chemists, both to pure magnesia and to the carbonate, in hot and in cold water.

According to Dr. Henry, water dissolves—
$\frac{1}{2000}$ of magnesia.
According to Kirwan, $\frac{1}{7900}$
According to Dalton, $\frac{1}{16000}$
Dr. Thomson states it to be entirely insoluble.

The same uncertainty prevails with respect to the carbonate.

Dr. Murray states that water takes up $\frac{1}{2000}$, and Mr. Brande, that this salt is perfectly insoluble.

Dr. Fife of Edinburgh has recently examined this subject, and finds that water at 60° dissolves $\frac{1}{5760}$ of its weight of magnesia, and that at the boiling temperature it takes up only $\frac{1}{36000}$. Magnesia then, like lime, has the property of being much less soluble in hot than in cold water.

It is the same with the carbonate.

Water at 60° dissolves $\frac{1}{2493}$
at 212° $\frac{1}{9000}$

To prove the greater solubility in cold than hot water, it is only necessary to heat, gradually, a transparent cold solution in a glass with a long narrow neck to prevent too great evaporation. At the instant of ebullition a flocculent matter is precipitated. *Ed. Phil. Journal.*

3. *Heat.*—The power of different substances to conduct heat, by transmitting it from particle to particle internally, has been newly examined by M. Despretz. He finds the conducting power of copper to be greater than that of iron, in the proportion of 12 to 5. Zinc and tin do not differ much from iron. The conducting power of lead is less than half that of iron, and five times less than that of copper. Mar-

ble conducts twice as well as porcelain, but the conducting power of marble is nevertheless but $\frac{1}{16}$ part of that of iron. Brick has much the same power as porcelain, namely, half that of marble. *An. de Chem. Jan.* 1822.

4. *Means of preserving eggs.*—M. Cadet of Paris, relates that on the 24th of November, 1820, he put half a dozen fresh eggs into a glass jar, and filled up the jar with lime water, containing an excess of lime. On the 8th of September, 1821, the Council of Safety charged Messrs. Marc and Pariset to examine the result of this trial. One of the eggs, which by accident was cracked without being broken, was found to be entirely coagulated, but did not emit the least unpleasant odour. The others were full and had preserved entirely their transparency. When boiled during three minutes, they appeared very delicate and of an excellent taste. *Idem.*

5. *Steam Boats* are employed at Stockholm (Sweden) for the purpose of towing ships into and out of port, when contrary winds prevail;—and this process is found to be much preferable to the method before used, in regard both to expense and celerity.

6. *Mechanics.*—The Emperor of Germany, convinced of the advantages which will result from a more profound knowledge of the theory and proper construction of water mills has lately offered a thousand golden ducats (about $2000) to the author, whether a native or a foreigner, who, in the course of a year, shall furnish the best work on that subject. As it is designed for the use of workmen, great perspicuity will be requisite. *Rev. Ency.*

7. Geneva.—*Society for the advancement of Arts.*—This society was founded in 1776, by the instrumentality of the celebrated Saussure. It has rendered very important services to the Cantons, and with a view to more extended usefulness, it has recently undergone some internal modification. It is now composed of three great divisions or classes, viz: that of the *fine arts*, that of the arts of industry, economy, and commerce, and that of agriculture. Any person who feels interested in the progress of the useful

arts, and wishes to contribute to their prosperity may become a member of either of the classes, simply by being proposed by two members, accepted by its committee, and paying the annual sum of forty florins, ($3,75 cts.) By a further contribution of twenty florins, he may become a member of either of the other classes. The members of each class enjoy the privilege of attending all its deliberations, of communicating their researches, of asking for information, proposing questions on the subject of prizes, electing committees, and assisting in the general meeting of the Society.

8. Geneva.—*Mutual Instruction.*—Notwithstanding its detractors, and the hostile insinuations which were recently advanced in the discussion relative to the best means of perfecting literary studies in Geneva, the plan of mutual instruction is making incessant progress. In the course of the last year, Lancasterian schools have been erected in the towns of Carouge and Versoix, and in the communes of Laney, Perly, Certour, Meinier and Cholex. The government, always ready to favour useful enterprizes, has liberally assisted these new institutions, whose beneficent influence it wishes to extend to all parts of the Canton. The large building newly constructed in the court of the college of Geneva, will contain 300 or 400 pupils. This large school is the third which has been instituted in the principal town in the Canton.—*Rev. Encyc.*

9. *Rural Economy.*—An experienced farmer of the Netherlands assures us that an ounce of saltpetre dissolved in a pint of water with an ounce of flour of sulphur, and scattered upon grain in a granary, is an infallible means of preventing it from spoiling.—*Idem.*

10. *Agriculture, Liege, Netherlands.*—One of the prize questions proposed by the "Society of Encouragement and Emulation," of that city, and decided at its public session last year, was, *Is it better to mow the first crop of grass in the season while it is still tender—or not until it has acquired full maturity and produced seed?* The prize was divided between C. J. Van Hoosebeke and H. P. Tilleman. They both decide, in their memoirs, that it is better to mow at

the time of inflorescence, because the plants are at that time more replete with nutricious juices. *Idem.*

11. Brussels.—*Encouragement to Science.*—Count Sack, who has published a voyage to Surinam in two volumes 4to, remarkable for the luxury of its typography, has received lately from the king, as a reward for the service he has rendered to science, a rich gold medal, very tastefully wrought. On one side is the portrait of the king, and on the reverse, this inscription :—*A Sackio, libero baroni, pro oblato munere litterario, rex*, 1819. M. de Sack proposes to make another voyage to America, and add new riches to those he has collected in that part of the world. An English translation of his first volume has already appeared.
Idem.

12. *Amsterdam.*—A society has for some time existed in this city for the amelioration of the instruction and civilization of the Israelites of the lower class. It is composed of persons of every sect, whose philanthropic efforts have already produced happy results.

13. *The Royal Academy of Paintings at Amsterdam*, has just been inaugurated in its new locality. The building is divided so as to accommodate 400 pupils. Already it has become impossible to admit all that have presented ; the number of whom exceeds 1200, which is certainly very considerable, since there exist in this city other establishments which have the same end, and which owe their origin as well to the care of the municipal authority as to that zeal for the arts which animates so many of the inhabitants.
Idem.

14. *Bourdeaux.*—Steam-boats meet with full success in this city. Four of them go daily from Bourdeaux to Langon, and ascend the river as high as the tide will admit. Two of them make the passage as far as Pauillac on the Gironde, and even in the season of sea bathing, to Royan. Another steam-boat constructed at Bourdeaux has been sent to Havre, where it is employed in crossing to and from Honfleur. An eighth will soon issue from the same ship-yard,

which is to be sent to Martinique for the service of that Island. *Rev. Ency.*

15. *Astafort.—Mutual Instruction.*—Two children extremely addicted to stuttering, were admitted to the Lancasterian school of this town. The frequent repetition of the exercises in a loud voice, and the assiduous care of the master, completely succeeded in curing them of this distressing habit which was the more difficult to remedy, as it was hereditary. *Idem.*

16. *Caen.*—A school of mutual instruction has been lately opened in the Central prison of Beaulieu, by the care of the director of that establishment. All the prisoners are willing to profit by the lesson, and their progress has been very satisfactory. The reading of religious and moral works has already had a remarkable influence upon them. No doubt remains that this result will be as happy here as it has been in other similar places, especially in the prison of Montaign at Paris, and in the *maison de detention* at Saint Dennis. *Idem.*

17. Paris —*The Linnean Society of this city* held on the 28th December, 1821, its first public annual session since its reorganization, under the presidency of M. de Lacépède. This day was chosen from its being the anniversary of the death of the illustrious Tournefort, who opened the way for Linneus and his disciples.

In the opening discourse, M. de Lacépède shewed the extent and importance of the labours of the Society, and felicitated himself on his having been one of its first founders in 1788, and on the happiness of surviving so many distinguished men who had been cut down by the fury of faction, to preside on this day at the reorganization of a society, destined to reestablish and to propagate the sound doctrines dictated by Linneus, and to finish the edifice erected to the genius of the Swede by the gratitude and admiration of French naturalists. This discourse was received with great applause.

M. Thiebaut de Berneaud, perpetual secretary, gave an account of the labours of his learned brethren. He first took a rapid view of the early period of the Linnean Socie-

ty, of the persecutions it had experienced, and of the melancholy end of its most zealous founders. He stated the efforts which had been made in 1797, to re-establish this firm institution ; and he gave a succinct analysis of the memoirs read at his private sessions. They are numerous, and extend to all the branches of natural history. This statement of the secretary and the memoirs to which it alludes, will appear in the first volume of the Acts of the Linnean Society. The eulogium on Tournefort was pronounced by M. Lefebure, one of the vice presidents, in which he forcibly recapitulated the services rendered by this philosopher. to the most attractive of the sciences. A discourse was pronounced by Dumont d'Unville, a skillful mariner and profound naturalist, on the Volcanic isles of Santorin. In the neighbourhood of Yuctot, department of the *Seine inferieure*, there is an oak remarkable for its antiquity, and for the existence of a chapel in the cavity of its shell. This chapel has been known one hundred and twenty-five years ; it is attended by a priest, who has his habitation in the upper part of the trunk. The top of the tree was broken off more than fifty years ago, and has been replaced by a steeple. The branches of this tree are covered every year with foliage.

The Society offer a gold medal of the value of 300 francs, to the author of the best memoir on the movements and condition of the sap in all the phases of vegetable life, and in the different seasons of the year. The results must be drawn from reiterated experiments and new considerations. *Idem.*

18. *A Religious Tract Society* has been established in Paris for the purpose of spreading either gratis or at a very low price, small tracts, which shall present under various forms the most important truths and the finest lessons of christianity as it is contained in the gospel.

19. *Conservatory of Arts and Trades at Paris.*—A new amphitheatre has been erected at this noble Institution, for the purpose of accommodating those who shall attend the lectures on the application of science to the arts. It is universally approved for its elegant form, its distributions and, the ingenious manner in which it is carved. The Session

was opened on the 8th of January last by Charles Dupin, in quality of professor of mechanics applied to the arts. He was followed by Clement Desormes, professor of chemistry, and lastly by J. B. Say, professor of economy of industry, (*èconomie industrielle.*)

20. *Mineralogy.*—F. S. Beudant is about to publish at Paris his mineralogical and geological tour in Hungary, in the year 1818. The price of the three volumes with the atlas, is seventy francs.

21. *The Himalaya chain of mountains.*—A report was made to the Asiatic Society of Calcutta, on the 17th of Feb. 1821, by Capt. Hodgson and Lieut. Herbert, relative to the trigonometric measurement of the mountains of the central chain of Himalaya. This important memoir contains, 1st, a physical description of those countries, and of the instruments employed in the operation. 2d, latitudes of the five principal stations deduced from a series of 122 observations of the height of the sun or stars. 3d, longitude of one of the stations, viz. place of departure, deduced from the latitude of Jupiter. 4th, the determination of a base of 27,000 feet. 5th, the chain of triangles to the number of 121. 6th, a table of heights above the level of the sea of thirty-eight summits or peaks of the mountainous chain, covered with snow. The greatest height is 25.589 feet, (= five miles nearly,) lowest height 16.043 feet. The Himalaya has more than twenty summits higher than Chimborazo.

22. *Tribe of Scotacks.*—Few geographers or translators have spoken of the *Scotacks*, a people of Hungary, remarkable with respect both to their number, and their manners. They are of Sclavonian origin, and form a race between the Sclavons, the Vasmiaks, and the Poles; but they differ totally from those nations by their dialect, character and customs. According to some travellers, they have, almost all of them, men and women, white hair, it being very rare to find any one with dark locks. They live in patriarchal style, and assist each other as parts of the same family; the father confides the oversight of his house to the son whom he thinks best qualified for the trust, and the others respect

and obey his orders, whatever may be his age. They are a pastoral people; they purchase every year in Transylvania and Moldavia, flocks of sheep which they fatten in the summer, and sell them afterward in the market of Hannasalva, or in Bohemia, Moravia, and Silesia. Many of them are waggoners, and transport wine and leather to Poland, Russia, Prussia, and Austria. The Scotacks never make war against the other tribes, on which account they have preserved their dialect free from the mixture of foreign idioms.—*Rev. En. Feb.* 1822.

33. *Geneva.*—A young lady born blind, but distinguished by her talents and amiable disposition, imagined that if some mechanic would invent a printing press adapted to the use of the blind, she could communicate her thoughts by that means to her distant friends. She imparted this idea to Francis Huber, the celebrated writer on Bees, who as it is well known, is also blind. Immediately by the help of his domestic, Claude Lechet, a man endowed with uncommon mechanical talents, Huber invented and constructed a press, which he sent to the young lady, with an assortment of types. After a very short apprenticeship, she was able to enjoy in perfection this precious method of communicating her thoughts. We have seen a letter of thirty-three lines addressed to her benefactor, composed and printed by herself, with common ink, without any fault or typographical irregularity.—*Idem.*

24. *The German Language* appears to be making rapid progress in Italy, and especially in Lombardy. Gratuitous professorships are every where erected. At the Lyceum of Milan, more than 200 pupils frequent the German course, and nearly 300 learn the language in other schools. The number of persons who are enabled to read the best German works, amounts, it is said, in that city, to 5000.

25. *Rome.*—The celebrated Abbe Mai, has discovered, it is said, some classic manuscripts which he thinks will probably prove as interesting as the treatise of Cicero *De Republica.* He hopes soon to publish a part of them.

26. *Lithography.*—M. Montin has discovered near the town of Cervesa, in Spain, a quarry of stone fit for Lithography. From experiments made at Madrid, in the lithographic press of de Brussi, its quality appears excellent. This discovery will be extremely advantageous to Spain, and even to the south of France.

27. *Maestricht.*—A school of mutual instruction has been some time established here, of which 250 of the pupils did not know even the alphabet, on their admission.—Nine months are found sufficient to enable them to read; but, what is more, in another nine months they become acquainted with the *French* as well as the *Dutch Language*, by reciting the lessons alternately in both. Their progress in writing is not less rapid, and in 18 months they learn to calculate. Many among them that had been for years in other schools without learning to count beyond a hundred, have acquired such a habit of calculating and reasoning, that the most difficult problems do not discourage them. Next year we shall learn how much time will be requisite for the study of the grammar of the two languages. The principles of linear drawing are to be taught to those in the 8th writing class. The success of this school shows that simultaneous instruction in the two languages, is perfectly adapted to *border schools.*

28. *Besançon—France.*—The Academy of Science and Belles-letters of this town, offers a gold medal for the best essay on the question—*To what extent has the principle of honour contributed to the splendor and true glory of the French Monarchy?*

29. *New Astral Lamp.*—M. Georget, lampist, Rue St. Honoré, No. 2, Paris, makes new lamps, of which the reservoir of oil is placed *above* the light, so that it furnishes a constant level by a uniform conductor. The *crown*, thus becoming useless, is suppressed; whence it results that the shadow produced by the horizontal circle cannot take place. These lamps have the further advantage of being easily transported, without the least danger of spilling the oil.

30. *A Carpet* has been manufactured at the Royal establishment of the *Savonnerie* at Paris, destined for the Hall of the throne, which is believed to be the largest that has ever been executed. It is 50 feet long, and 30 wide, and might have been done in one peice agreeably to the design, but it would have required in that case, 9 years for its execution. For the sake of greater expedition it was divided into three parts which have been accomplished in three years. Agreeably to the details that have been furnished, it has cost in labour alone 50,000 francs, ($10,000.)

31. *Iodine as a Medicine.* We have already stated the beneficial results which M. Coindet had obtained in employing Iodine in the treatment of Goitre; but then this curious substance was administered internally, and we have had occasion to remark that in some cases, unpleasant symptoms were produced by the local action of the Iodine upon the mucous membranes of the stomach. The same physician has since tried to introduce this substance into the animal economy by simple friction, and he announces a success equal to the former. Twenty-two patients of different ages and sexes, have been treated by this new process. They had all very large goitres; more than one half of them were completely cured in the space of from four to six weeks, and the others in a greater or less degree. The ointment which Dr. Coindet employs, is composed of half a gros of hydriodate of potash with $1\frac{1}{2}$ oz. of hogs lard. The part is rubbed morning and evening with a portion of ointment as large as a nut, until the whole is absorbed.

Dr. Coindet states that he has used Iodine in the treatment of scropula, "with a success which surpassed his hopes."—*An. de Chim.*

32. *The Muriate of Copper and Nitrat of Soda of Peru* —From a statement made by M. Mariano de Rivero, a Peruvian, it appears that the muriate of copper, so much admired for its fine colour, is found in large quantities in the district of Tarapaca, in the gold and silver mines. It accompanies the ore called *Yabicoia*, and is found in veins, in such quantity, as to give rise sometimes to extensive workings. The Indians of Atacama extract it, grind and sift it, and sell it in the state in which we see it. They call it

Arcnilla. It is used in all Peru and especially in the province of Arequipa and in Chili as sand in letter writing. The muriate in these grains is mixed with quartz which is its gangue.

The nitrate of soda in the district of Atacama is found in beds of variable thickness, extending more than fifty leagues, covered with clay. The quantity is so great that more than 40,000 quintals have already been obtained, and the proprietor will engage any portion that may be desired. The salt in some places is extremely pure; in others it is mixed with clay, which is easily separated by solution and crystallization.

33. *Galvanic Instruments.—Electro Magnetism.*—The beautiful discovery of Oersted of the magnetic power of the galvanic battery, has excited the zeal of philosophic experimenters almost every where. A magnificent apparatus was constructed last year at the Imperial Museum of Florence, under the direction of Count Girolamo de Bardi, director of that establishment; and the experiments with it were performed by himself, assisted by M. Gazzeri, professor of chemistry in the hospital of S. Maria Nuova of that city, and Car. Antinori, professor of a philosophical cabinet, together with Prof. Pictet, and Dr. Marcet, of Geneva, who were then in Florence.

This machine consisted of six plates of zinc each, with a double surface of copper, and containing in the whole 41016 square inches of active surface. The plates of copper were put together so as to form cells or troughs, in each of which a zinc plate was immersed and kept insulated from the copper by being previously put into a linen bag. Brass conductors establish the communication between the zinc of each trough and the copper of the adjoining one. Any of these conductors could be instantly removed or replaced, by which means the voltaic current could be stopped, or the whole or any part of it be brought into immediate activity. With a long funnel of six orifices, the whole of the troughs could be filled at once. The troughs were well compacted in a wooden frame and mounted on small wheels. The calorific power of this machine was such as to ignite fourteen inches of platina wire one third of a line in diameter, in a few seconds. A steel wire of twice

the diameter was melted in five seconds. A careful estimate of the calorific power of this instrument, was made by Prof. Pictet, in successive intervals of one minute each, by immersing the conducting wire in a silver cup which weighed fifty-nine grains, containing seventy-two grains of water, into which a thermometer was plunged with a very small bulb. The bulb rested on the conducting wire in the bottom of the cup. When the conducting wire was about eight inches long, the thermometer rose in one minute from 43° to 82½° Fahrenheit, and in one instance, with a very short wire, from 43° to 111° Fahrenheit, in the same time. With a short platina wire as a conductor, the water soon acquired the boiling temperature ; and what was well worthy of remark, the ebullition ceased *instantly* on the interruption of the circuit, and *instantly* re-commenced on its renewal, without any appreciable time between the cause and effect. This fact appears to prove that the progress of heat in the galvanic battery, from its connection with electricity, is, like the latter, altogether inappreciable, *notwithstanding that it moves this solid matter.*

When the conjunction between the poles was formed by two platina wires, of different diameters, placed parallel to each other, the larger wire was always ignited, but the smaller one never. When the same two wires, attached end to end, formed the connection, the smaller wire was always ignited, when attached to either of the poles.

A sewing needle, placed at right angles to the conjunctive wire and above it, acquired magnetism in three seconds.

When the conjunctive wire was placed exactly in the direction of the magnetic meridian, a magnetised needle, freely suspended under it, declined 72° from the N. to the W.

Two conjunctive wires were placed very near each other, but without touching ; they then cut each other at right angles, in a horizontal place. A magnetic needle was then brought under them, and its north pole stood between the south and east, and when placed above them, the same pole stood between the north and west. The conjunctive wire was twisted into a spiral form and placed with its axis in the magnetic meridian. The needle being placed under the spiral, its north pole deviated 70° from N. to W. and when

placed above the same spiral, the needle took the opposite direction.

A platina wire which formed part of the voltaic circuit, strongly attracted iron filings, (as Mr. Arago had observed with respect to copper.) A tin wire did the same, but melted almost instantly.

The following experiment was made with the common electric machine :—

A needle was placed within an iron spiral, and the Leyden bottle was discharged through the latter. The needle was magnetized but not the spiral. This was repeated many times with the same results.

M. A. Van Beck, of the Philosophical Society of Utrecht in Holland, also states the results of an experiment with a single combination of copper and zinc. The zinc plate was 3600 centimetres, (about 1440 inches,) square, and the plates of copper were, as in the Florence machine, formed into a trough which contained the fluid, consisting of sixty parts water, one part sulphuric acid, and one part nitric.

The galvanic current being disposed in a direction parallel to the magnetic meridian, caused a needle eight inches long to decline 70° to the E. and to the W. according as it was placed above or below the conductor ; whilst with a very small and susceptible needle, the galvanic current seemed to prevail entirely over the terrestrial magnetism, in giving it a declination of 90°.

The conjunctive wire, in this instrument, also attracted iron filings very forcibly. The filings remained attached to it as long as the poles were united, but fell off immediately on the cessation of the current.

A small bar of steel was perfectly magnetised, by M. Van Beck, in five minutes, by placing it in a tube of glass surrounded spirally by a brass wire which formed the connection. The north pole is formed on the negative side when the spiral is wound from the right, and on the positive, when it is wound from the left. He also proved that steel may be magnetised in the same manner with great facility by the common electric machine, by a discharge of the battery through the brass spiral, or even that of a Leyden bot-

tle. Indeed when the current is drawn through the spiral by taking sparks from the conductor, the steel becomes evidently magnetized.* *Bibliotheque Universelle.*

34. *Electro-Magnetism.*—Professor C. W. Böckman, of Carlsrüke Baden, in a memoir addressed to Prof. Pictet, states that he has repeated the experiments of the Chev. Yelin, of Bavaria, relative to the magnetism produced by common electricity, and finds that when steel needles are either enclosed in a glass tube or enveloped in waxed cloth, silk, wood, ivory, or paper, and a wire turned spirally round the envelope, the steel is always magnetised when a Leyden bottle is discharged, or when strong sparks are passed through the spiral wire. He has demonstrated that the magnetic force increases with the electric tension or number of discharges to a certain extent, when it acquires a maximum.

It seldom went beyond fifteen or twenty discharges, with common electric bottles. The magnetism appears also to be increased by increasing the number of turns in the spiral wire.

* After the paper, "On the magnetic effects produced by Dr. Hare's Calorimotor," was printed, Professor Silliman received the notice in the text. I was entirely ignorant of the experiments of Mr. Van Beck, when mine were undertaken, and all the information I now possess on the subject is derived from the above notice. There seems, however, to have been a difference in the results obtained by Mr. Van Beck and myself; that gentleman found that the end of the needle which was connected with the zinc plates of his battery, acquired *north* polarity when the turns of the spiral of brass wire about the glass tube passed from *left to right*—and *south* polarity, when they passed from *right to left*. The results obtained by me were directly the reverse of these ; and in my experiments, (which have been often repeated in the presence of Professor Silliman,) the end of the needle connected with the zinc plates, *always* acquired *south* polarity when the turns of the spiral passed from *left to right*, and *north* polarity when they passed from *right to left*.—I will now add the result of an experiment which has been performed since the publication of my paper. A brass wire was wound about a glass tube from *left to right*, until half of the tube was covered by the wire, when the direction of the spiral was changed, and the wire wound about the remaining half of the tube from *right to left*. A needle, free from magnetism, having been enclosed within the tube, the ends of the spiral were connected with the opposite poles, and the plates immersed, and again raised from the fluid. On removing the needle, its two ends were found to have acquired north polarity, while the middle had acquired south polarity. This experiment was often repeated, and the same results obtained.

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He found that magnetism was produced in a needle, fixed in the axis of a glass cylinder or bottle of eight inches, and even of thirteen inches in diameter, surrounded by a spiral. He contrived to turn a metallic wire into a spiral of seven feet in diameter, and found that needles placed in the axis were slightly magnetised by strong discharges through the spiral. *Idem.*

Prof. Erman, of Berlin, has shown the connection between magnetism and voltaic electricity, in the following ingenious way. In a silver or copper crucible he places a watch glass, and in the glass a small mass of zinc. A strip of zinc or of tin is fastened at one end to the mass of zinc, and extending upwards and outwards over a pasteboard band in which the cup rests, it is fastened at the other to the cup itself. This forms a complete voltaic circuit, and the current is established as soon as the cup is filled with acidulated water. When the apparatus is suspended to a thread, and a magnetic bar is brought near it, either an attraction or a repulsion takes place, according to the direction of the galvanic current in the apparatus and the magnetic current in the bar. *Bib. Univ.*

35. *Estimation of the mass of water which flows down the Rhine, at Bâle.*—The determination of this curious problem has been undertaken with much address by M. Escher, of Linth. The rise and fall of the water is ascertained with sufficient precision by a *Rhonometre.* A section of the bed of this river was obtained by measurement, and the mean velocity of the water carefully determined. The result is that the medium quantity of water which flowed down the Rhine in one year, is 1,046,763,676 cubic toises of 1000 feet each.

To form an idea of this volume, the author supposes for a moment a basin of fifteen leagues in length and five in breadth ; for example, the lake of Constance. He found that the flow of the Rhine in 1809, poured into that basin, would raise it to the depth of fifty-six feet. If then the lake of Constance were empty, it would require many years for the Rhine at Basle to fill it, for the mean depth of that lake, in all probability, greatly surpasses fifty-six feet.

It would be interesting to the readers of this journal to be able to compare with the above result, the cubic amount of water which flows annually down the precipice of Niagara, by actual measurements of the river at some convenient place above the falls, and accurate calculations founded upon them. An estimate might be formed of the whole mass of Lake Erie; and admitting that it received no supplies, the time requisite to disembogue itself at the present rate of discharge over the falls might thus be approximated.

36. *Hospital of Mount St. Bernard.*—It appears in a "Notice or memoir upon the natural history of St. Bernard," by the Pere Biselx, prior of the convent, that from thirty to thirty-five thousand rations of food are annually distributed to travellers of all conditions. The cold and exposed situations which the benevolent inmates of that great hospital voluntarily inhabit, subjects them to acute and incurable rheumatisms, and obliges them when still young to descend to the plains, and drag out a life of pain and distress. This evil is found to be susceptible of remedy by such alterations of the edifice as modern science is competent to effect; but their funds are exhausted in the relief they extend to the pressing wants of travellers. To enable them to accomplish those improvements so essential to their own comfort, a subscription has been proposed, and *De Candolle* and *Turretini*, bankers of Geneva, have agreed to become the depositaries of whatever may be offered for that purpose. Their correspondents in London are P. L. Le Cointe & Co. and in Paris, Vassal & Co. Professor Pictet and De Candolle, of Geneva, are associated with the bankers in the disposal of the funds. *Bib. Univ.*

37. *Extensive Draining.*—The Prince De B. a very rich landed proprietor in the government of Koursk in Russia, had on his estate a marsh or swamp of 7800 acres, which in the spring of the year became a lake. and produced absolutely nothing but reeds and rushes. In its driest state neither man nor beast could cross it without hazard.

In the course of his journies in other parts of Europe, especially in England, the prince became satisfied that his lands might be rendered much more productive. An Eng-

lishman, on learning the situation of this marsh, undertook to drain it ; and in the course of a year from its commencement, the work was completed, and this vast tract which was only a reservoir of unwholesome miasmata was converted into a fertile soil, adapted to the various agricultural productions. This prince having tried all the pleasures which fortune and high rank can yield in the luxuries of a court, has retired to his estates, and finds in a devotion to objects of utility and to the amelioration of his people, the secret of being truly happy. *Idem.*

38. *Galvano-magnetic-condenser.*—A delicate instrument for exhibiting the magnitiferous property of a weak galvanic combination, has been invented by M. Poggendorf of Berlin. It is simply a wire rolled in the form of a spiral so as to make thirty or forty turns. The wire is covered with silk in the same manner as the large cords of a harpsichord are with fine wire. The spiral is placed vertically, and a steel needle, not magnetic, is suspended horizontally within it, on a vertical pivot. Thus arranged, if one end of the spiral be brought into contact with a zinc plate, and the other end with a copper plate, and the zinc and copper be each connected with a humid substance, or water acidulated with nitric acid,—the needle soon acquires polarity, and arranges itself in the magnetic meridian. M. Oersted considers a needle thus mounted as a *galvanoscope* much more sensible than a prepared frog. *Ed. Phil. Jour.*

39. *A soft crystal of quartz.*—In a memoir on the marble of Carara in Italy, by Em. Repetti, the following singular fact is mentioned by the author.

In the spring of 1819 Mr. del Nero proprietor of one of the quarries in the Vossa del l'Angelo, in sawing out a large block destined for a column in the temple of St. Francois at Naples, discovered in the interior of the marble, what the workmen term a *lucica*, viz. a crystal of calcareous spar of considerable size. In digging this out they found a cavity in the marble lined with crystals of quartz, and containing about a pound and a half of liquid perfectly transparent and slightly sapid. They observed with surprise in this cavity a protuberance as large as a finger, transparent and which appeared to have all the characters of a rock crystal of that

size. M. del Nero, delighted to find himself in possession of one of the finest crystals of hyaline quartz, which the country had produced, proceeded to disengage it at the base; but to his inexpressible surprise, he found it elastic and of a pasty consistence, taking any form his hand gave it, but rapidly growing harder, and soon becoming quite solid, and assuming the appearance of calcedony or porcelain. In a moment of vexation he threw it among the rubbish, and thus lost a specimen which would have been highly interesting to the curious.

He assured me, (and his assertion was repeated by other witnesses worthy of confidence) that facts of the same nature had occurred to them more than once. I made him promise that if another such instance should present, he would impress his seal upon the crystal and send it to me at Florence, with the water which the cavity might contain. Professor Pictet remarked that he saw at Florence in the collection of Dr. Targimi, a rock crystal containing several drops of petroleum in small cavities without communication with each other or with the air. One of them was opened to satisfy Sir H. Davy, when at Florence, of the nature of its liquid contents. *Bib. Univ.*

40. *A simple but interesting galvanic instrument* is described by Professor De la Rive of Geneva in the Bib. Univ. of December last. A strip of zinc about the sixth of an inch wide, and another of copper are passed through a small cork float, so that the copper shall bend round the end of the zinc and in some measure enclose it. To the upper part of each strip, the extremities of a copper wire, previously covered with silk and rolled into the form of a ring by seven or eight turns upon itself, are to be soldered. The ring should be an inch or an inch and a half in diameter. When this float is placed in a vessel containing acidulated water, the galvanic current is established. If a magnetic bar be then presented to the ring, so that the currents proceed in the same direction, the ring will be attracted and will pass over the bar; but if the other pole be presented the ring will be repelled; but at the same time it will seek to take another position by turning half round and will then return to the bar and pass over it.

If this ring have a diameter of three or four inches, and the instrument be not too heavy, it possesses the power of self direction, always arranging itself in a plane perpendicular to the magnetic meridian. *Bib. Univ.*

41. *Two other ingenious and simple instruments for shewing the effect of Electro-magnetism*, are described in the recent journals. One* of these, by P. Barlow, Esq. of the Royal Military Academy, is as follows:—

"A B (see the plate at the end) is a rectangular piece of hard wood; C D E a stout piece of brass or copper wire and *a b c d*, a rectangle of smaller copper coin, (soldered at E) on the lower side of which the wheel W of thin copper turns freely: *f g* is a small reservoir of mercury sunk in the wood; *t g i* a narrow channel running into it. H M is a strong horse shoe magnet.

"Mercury being now poured into the reservoir *f g* till the teeth of the wheel are slightly immersed in it, and the surface covered with weak diluted nitric acid, make the connection with the battery at *i* and D: and the wheel W will immediately begin to rotate with an astonishing velocity, far beyond the power of the eye to follow, and will thus produce the most pleasing effect."

"The galvanic apparatus which I employed to produce this motion was the Calorimotor of Dr. Hare which I had made of the plates of my old battery, 20 of zinc and 20 of copper, each ten inches square. But a much less powerful combination will be sufficient."

The suspension of the wheel is shewn in figure 2, and it may be proper to add, that in order to ensure a complete contact, the two sockets, or the end of the spindle, should be amalgamated, as also the tops of the points of the wheel.

"If the contact be changed, or if the magnet be reversed, the motion of the wheel will be reversed also: but I find the best effect produced when the wheel turns inward.

42. *An Iron Steam Boat* has recently made a voyage from London to Rouen in 55 hours, and then proceeded to Paris. This is doubtless the first attempt to traverse the ocean in a vessel composed of any material but wood.

* For the other, see Phil. Mag. for June, pa. 434.

The Tyne Mercury mentions a new iron boat having been launched at New Castle, thirty one feet in length, which draws only two inches of water. *Til. Mag.*

43. *Canal Steam Navigation.*—With a view to the introduction of steam vessels on canals, a very interesting experiment was made in the Union Canal at Edinburgh, on June 22, at 2 o'clock, with a large boat twenty-eight feet long, constructed with an *internal* movement upon the principle of a model invented by Mr. Wight, and exhibited to a general meeting of the Highland Society of Scotland in the month of January last. A committee appointed for the purpose by the Directors of the Highland Society attended to witness the experiment, and the chairman and most of the members of the Union Canal company were also present. The boat had twenty-six persons on board; and although drawing fifteen inches of water, she was propelled by men at the rate of between four and five miles an hour, while the agitation of the water, being confined entirely to the centre of the canal, was observed to subside long before it reached the banks, and consequently obviating its hitherto destructive tendency in washing them into the canal. *Star.*

* * * * * * *

44. *Mr. Brongniarts Notice of American Specimens of Organized Remains.*—A letter from Mr. Alexander Brongniart to the Editor, dated May 23d, 1822, expresses great interest in, and gratification from, the various specimens of American organized remains which he had received, especially from those forwarded through the Editor, from Mr. E. Hitchcock of Massachusetts, Mr. E. Granger of Zanesville Ohio, Mr. Z. Cist of Wilkesbarre, and Mr. G. T. Bowen of Providence. Should the friends of Geology continue (which it is earnestly hoped they will,) to furnish similar specimens to Mr. Brongniart he will soon be in a condition to draw those general conclusions respecting the American formations by means of which they can be successfully compared with those of the Eastern Continent.

45. *Professor Berzelius.*—A letter has been received by the Editor from Professor Berzelius of Stockholm, dated April 22d, 1822, accompanied by a collection of Swedish minerals. Among them is the chondrodite, which Professor

Berzelius remarks, "is the same as the American Brucite." Indeed it obviously agrees in its characters with the mineral whose analysis by Mr. Seybert is published in this Number. The Pyroxene Sahlite transmitted by Mr. Berzelius is identical with that found near New-Haven, and whose analysis by Mr. Bowen is found at p. 344.

46. *New Edition of Parkes' Chemical Catechism.*—Mr. Parkes has published the 10th Edition of his catechism and an 8vo Edition of the Chemical Essays, is going through the press, as we learn by a letter from the author. *Edit.*

II. DOMESTIC.

1. *Natural Ice House near Williamstown.*—Extract of a letter from Professor Dewey, dated August 16, 1822. In No. 10 of the American Journal of Science and Arts, pages 331, 332, is a notice of the Natural Ice House near Williams College. The reference to my name makes it necessary for me to request the insertion of the following additional remarks. This *Snow Hole*, as it is commonly called, is about a mile northwest of the northwest corner of Massachusetts. As the southwest boundary of Vermont is west of this corner of Massachusetts, the Snow Hole is believed to be in the town of Pownal, Vermont, and very near the line which divides it from the state of New-York. The lat. and long. are a few minutes greater than those given by Mr. Dearborn. In No. 4 of this Journal I had already given an account of this Natural Ice House. The dimensions of the chasm are rather greater than those assigned by Mr. Ives. I visited this Snow Hole a few days since, and found, on *accurate* measurment, that both the length and depth were a little greater than those I had already given, the width being correct. The form of the chasm is entirely irregular.

Very little ice or snow was to be found in the Snow Hole. The trees have been wantonly cut down to such an extent within some years past, that the snow is entirely melted, about the first of August. There are several chasms near this principal one. A few rods farther north is one of nearly equal dimensions, and more fully protected by the ledge

of rocks on its southern side. In this was abundance of ice and snow, some of which will probably remain through the year. The hand of man will probably destroy these natural depositories of snow, and, in a few years they will doubtless be known only as the places in which snow used to be preserved through the year.

2. *Prismatic Mica.*—Professor Dewey.—This mineral is found in Hinsdale in this county. It is on the edges of common mica like that of Saratoga. Only three or four very small fibres are often found on the edges of one of the lamina.

Mineralogical Notices, by Dr. Torrey.

3. *Green Zinc Ore of Ancram*, (Ancramite.)—All the specimens of this mineral which I have seen, except one in the possession of Prof. Renwick, of Columbia College, have evidently undergone the action of fire, so that some have supposed it to be an artificial substance. The specimen of Prof. Renwick seems, however, to remove all doubts on this subject, as it has every appearance of a native mineral. Several excellent mineralogists who have seen it, have pronounced it so. This interesting ore has not yet been discovered *in situ*, although diligent search has been made for it since my account of it was published.

4. *Stilbite.*—A new locality of this mineral has lately been discovered by Governeur Kemble, Esq. in the highlands of New-York, opposite West-Point. It occurs in a decomposing cellular blueish feldspar, forming a vein in gneiss, in small aggregated crystals of a honey yellow colour. The crystals are four-sided prisms, with rectangular bases, about one eighth of an inch long, with several smaller and gradually diminishing cuneiform crystals applied to two opposite sides ; giving the crystals a radiated appearance, with deep re-entering angles on the sides. The summits are truncated at the terminal edges, slightly bevelled in the direction of the laminæ of the crystal, which is also the case with the cuneiform additions. The faces produced by truncation and bevelment are brilliant, but the sides of the prism are often dull.

This mineral is easily cleaved in one direction, exhibiting brilliant folia, with a slight pearly lustre. It is hard enough to scratch glass feebly. By the heat of a candle it distinctly exfoliates, and before the blowpipe, intumesces considerably. It does not form a jelly with acids.*

5. *Siliceous Oxyd of Zinc.*—On examining a few weeks since, some specimens of minerals brought by Mr. Nuttall, from Franklin furnace in N. Jersey, I found among them the siliceous oxyd of zinc. It occurs in irregular masses, from an inch to three inches in diameter, disseminated in Franklinite. It is generally more or less mixed with the red oxyd of zinc. Its appearance when pure much resembles granular quartz. In fine powder it dissolves immediately in nitric acid, and the solution gelatinizes strongly. Since I examined this mineral, Dr. Langstaff informs me that he discovered it many years ago in the same place where it was found by Mr. Nuttall.

Mr. Geo. Boyd, a young and promising mineralogist, of this city, has just returned from a visit to Patterson and the neighbourhood of Sparta, and has brought with him a good collection of the minerals of these interesting localities, most of which are described in Mr. Nuttall's memoir. At the former place he examined the well where the Datholite is found. It occurs in large geodes in trap, about twenty feet below the surface of the earth. Some of the crystals which he found were an inch in length. But very small quantities of Datholite have yet been found except at this place.

6. *Franklinite.*—A fragment of this mineral, two inches in diameter, with four very perfect sides, was found by Mr. Boyd, near Franklin Furnace. He also found small crystals of the same mineral, exceedingly perfect, and with a lustre little inferior to that of spinelle. They were octahedral, with the common base and lateral edges truncated. On examining these crystals, which were more perfect than those I received for Mr. Nuttall, I make the angle of the inclination of the pyramids 109°, which is almost exactly that of spinelle.

* I have been particular in describing this mineral, as the Stilbite has been recently divided into several species, and it is probable this constitutes one of them. J. T.

7. *Sulphuret of Molybdena, &c.*—This was found by Mr. Boyd, four and a half miles from Hamburg, N. J. imbedded in a mineral which is probably a variety of augite. It occurs in laminæ, sometimes more than an inch in diameter. In the same locality he found beautiful massive blue fluate of lime. He also brought with him several other rare minerals, but as they were found a short time before by Professors Keating and Vanuxem, who are preparing an account of them for publication, I think it would be improper in me to anticipate them.

8. *Zircon from N. Carolina.*—I have made an accurate goniometrical measurement of this mineral, and find the angles to agree very nearly with those given by Haüy. The faces of the prism form with the corresponding angles [faces? Ed.] of the prism, angles of 131° 35′. In the second edition of Cleaveland's mineralogy, they are said to measure about 135°. The angle of inclination of two faces of the pyramid 94° 30′.

9. *Summerville Copper-Mine.*—I lately visited the copper mine of Mr. Cammams, near Summerville, (New-Jersey.) They are situated in a trap or Greenstone mountain. The ore which is worked, is the red oxyd of copper. The following are the principal minerals yet found there:

Native copper, in irregular masses, weighing from one ounce to eight pounds. One specimen lately found weighed twenty three pounds.

Phosphate of Copper, massive, and of a verdigris colour. It generally accompanies the native copper. This mineral is not noticed by Cleaveland, as a N. American species

Carbonate of copper, green, and in connection with the phosphate.

Red oxyd of copper.—The massive variety is the common ore of the mines. It is also found crystallized in octahedra the surfaces of which are exceedingly brilliant. Many specimens found at the mines exceed in beauty any I have seen from Cornwall.

Native silver, in small masses disseminated through the phosphate and crystallized red oxyd of copper.

Green quartz, in tabular, partly noded masses. A beautiful mineral, resembling chrysoprase.

Prehnite, in cavities in the greenstone, very fine.

Mountain leather, in thin plates, very tenacious when moistened.

10. *Jeffersonite.*——Professors Vanuxem and Keating have published in the Journal of the Academy of Natural Science in Philadelphia, an account of a mineral discovered in Sparta, N. Jersey, to which they have given the name of *Jeffersonite.* It has a great resemblance to Pyroxene, (Augite,) but is conceived to present such differences as to justify arranging it as a new species. Its analysis gives—

Silex, - -	0.6125
Lime, - - -	0.1463
Protoxide of Manganese,	0.1404
Protoxide of Iron, -	0.1005

11. *Automalite.*—Professor Vanuxem has announced a new locality of this mineral at Franklin, N. Jersey.

12. *Notices of Mineral Localities, by Mr.* THOMAS H. WEBB, of Providence, R. I.

1. *Chlorite slate*, of a deep green and blackish brown colour, occurs in great quantities at Smithfield, about ten miles from Providence. It consists for the most of undulated layers, having more or less of a glistening surface, and a slaty fracture. Some parts of it have an earthy structure.

2. *Octaedral crystals of magnetic oxide of iron* are found imbedded in some parts of the abovementioned mineral, in great abundance.

3. *Ligniform asbestus* of a brown colour, with a greenish cast also occurs in the same vicinity.

4. There is likewise found here, a shining yellow sand, that appears to have been formed from fragments of decomposed mica.

5. *Titanium*, near the fluor rock, (in Sekonk,) in the crevices of some of the rocks, small irregular yellowish

crystals. The substance was analized by Dr. J. W. Webster, of Boston, and proves to be the "Prismatic Titanium ore of Mohs, the Sphene or Titane siliceo calcaire." He thinks there is also an oxide of Titanium in the rock.

6. *Cyanite.*—A specimen of it was brought in town a short time since, by the person who owns the place where it is found. He thought it contained silver or platina. Nothing however was known concerning its situation. In company with Mr. Amos Binney, jr. of Boston, I visited the place about three weeks ago. It is found on a Mr. Blanchand's land, in Foster, R. I. about twenty-one and a half miles south-west of Providence. It was first observed by him three years ago, while engaged in digging a water-course for a grist-mill. The specimens that we obtained had been weathered for some time. Some of the specimens were contained in quartz; other pieces appeared to be composed entirely, or in a great measure of Cyanite, held together by the intervention of small quantities of quartz. It occurs in long lamellar masses, and in masses that bear evident signs of irregular crystallization. Its colours are, a fine deep blue, a pale blue, and a pale green. Some pieces have a strong pearly white lustre, and are covered with beautiful blue stripes. There is a layer of black mica slate accompanying it.

It is an uncommonly beautiful mineral.—*Editor.*

13. *American Geological Society.*

The Cabinet of this Institution continues to receive valuable additions. A second collection of European rocks has been received from its President, William Maclure, Esq. and this gentleman, in addition to the books formerly mentioned, (Vol. III. pa. 360,) has recently forwarded to the Society's Library eleven Vols. of the Revue Encyclopedique, from its commencement in January, 1818, to September, 1821; also, Vols. 89—90—91 and 92 of the Journal de Physique, with the four last numbers of Vol. 37.

The volumes from 54 to 87 wanting to complete this Journal, will be forwarded as soon as they can be obtained. Valuable boxes of minerals, chiefly rock specimens, have been received from Professor Olmstead, of Chapel-Hill,

N. C.—from Dr. Allen, of Bratileborough, Dr. Porter, of Plainfield, Mass. and from James Pierce, Esq. of Catskill. The latter box illustrates the organized remains of the Catskill Mountains. Many of the impressions as well as of those which have been preserved in relief, are singularly distinct and delicate.

14. *Second edition of Cleaveland's Mineralogy.*

A review of this valuable work appeared in Vol. I. pa 35 of this Journal. We have found no occasion to alter the favourable opinion there expressed ; nor are the alterations in this edition sufficiently numerous to demand any new remarks.

One hundred and fifty-two pages of new matter, occupied chiefly by accounts of American localities have been added. "A few descriptions of new species and varieties have been introduced, and an appendix on meteoric stones." Some alterations—chiefly in arrangement, have been made, in consequence of the suggestions of friends in private communications, of reviews, &c. They are such as meet our approbation, and we doubt not that this excellent work will in its improved form, continue to receive, both at home and abroad, those decided marks of public favour, which were so liberally bestowed on the first edition.

15. *New Manuals of Chemistry.*

1. An Introduction to Chemistry, with practical questions, designed for beginners in the science. from the latest and most approved authors. to which is added a Dictionary of Terms : by John Ruggles Cotting, Lecturer on Experimental Philosophy.

2. A Grammar of Chemistry, on the plan of the Rev. David Blair, author of a Grammar of Natural and Experimental Philosophy, Universal Preceptor, &c. &c. adapted to the use of schools and private students, by familiar illustrations, and easy experiments, requiring cheap and simple instrumets ; by Dr. J. L. Comstock, with numerous engravings on wood.

16. *New edition of a Grammar of Natural and Experimental Philosophy; by Rev. David Blair.*

An improved and enlarged edition of this work, under the direction of Dr. Comstock, has been published at Hartford.

17. *Formation of Calcareous Spar.*

It is not often that we can detect those causes actually at work by which natural mineral crystals are produced. It may therefore be interesting to mention the following circircumstance:—Mr. Stephen Huggins, of New-Haven, on pouring out the contents of a bottle of Saratoga mineral water, which had stood several years in his cellar, found some well defined crystals and fragments of calcareous spar at the bottom of the bottle. They are now in my possession, and have the full lustre and the proper cleavage of Iceland spar, only their colour is a little yellow—owing, without doubt, to the carbonat of iron, which along with the carbonat of lime, forms a part of the contents of this powerful water, and is suspended in it by a high charge of carbonic acid to which the water owes its great briskness.—*Ed.*

18. *Catskill Lyceum.*—James Pierce, Esq. President of the Lyceum has recently read to that body two very interesting and instructive papers—the one on the various breeds and the economy of sheep, and the other on the nature and benefits of irrigation. Both papers are replete with interest, and do honour to the Lyceum of Catskill, which is not behind its sister Institutions in efforts to promote useful knowledge.

19. *Fluor Spar and Oxide of Titanium.*—Extract of a letter from the Rev. Edward Hitchcock, dated Conway, May 18th, 1822.

"I recently discovered the green fluate of lime in this town, in a vein of Mica slate, though in small quantities. It phosphoresced. If I mistake not, I have found also on crystallized quartz, not only the common eight sided geniculated prisms of the red oxide of Titanium, but also that mineral, under its primitive form, viz. a rectangular prism

with square bases—the sides of the crystal are not more than a fourth of an inch—and I found only two or three specimens. Tabular and radiated quartz occurs abundantly in this town, and most beautiful graphic granite.

20. *Bituminous Substances of Barbadoes.*—The editor has recently received from James R Sample, Esq. of Barbadoes, specimens of the Barbadoes Tar, called in that Island Green Tar, and of the indurated Bitumen; there called Manjack. The green tar is petroleum of an excellent quality. Mr. Sample remarks that the Tar "is found very useful in preventing lockjaw, when the first symptoms are attended to, by rubbing the spinal bone from end to end, and the muscles of the thigh and arms; when taken internally it is also a powerful sudorific. Of the Manjack I have lately made an excellent pitch with tar and tallow, which makes wood impervious to water, and I have no doubt would also make a good varnish."

21. *Oil stone of Lake Memphremagog.---Notice of two quarries of stone, lately discovered in Lake Memphremagog, Lower Canada.*—Communicated by Mr. Austin O. Hubbard of Stanstead, L. Canada.—The island on which the whitish stone is found, is one hundred rods long, and from sixty to seventy broad. The ledge from which the stone is taken, is situated at the southeast corner; and that part of the ledge which lies above the water, is about twelve rods in circumference. How far it extends into the lake, has never been acertained. The island itself is about half a mile from the eastern shore of the lake, and seven miles west of Stanstead village. The quarry which contains the oil-stone, lies a few miles north of the island above mentioned, close to the eastern shore. It is wholly covered by the water, and is some times six inches, and at others, three feet below the surface.

Mills have been erected on the shore of the lake, and great quantities of these stones are annually prepared for exportation. The coarser stone is found to be good for common purposes, and the oil-stone is said to be equal, if not superior to that of Turkey. Indeed some idea may be formed of their excellence, from the fact, that since the discovery of the two quarries, (about two years) the profits of the proprietors have exceeded $5000.

22. *Fluate of Lime and noble Agates in Deerfield, Mass.* Dr. Cooley has discovered in Deerfield, purple fluate of lime, crystallized I believe in dodecahedrons--though I could not determine this certainly as I had no glass when I examined it. He also finds *noble agates* in a new locality in our Deerfield greenstone.

Letter from Rev. E. Hitchcock, March, 5, 1822.

23. *Useful Minerals in North Carolina.*—(Extract of a recent letter from Professor Olmstead.) I have recently performed a tour westward, almost to the blue ridge through the counties of Rockingham, Stokes, Surry and Guilford. The objects which among others were presented to us were the following.—An independent coal formation hitherto unobserved, embracing at least two beds of coal, fine varieties of Sandstone, numerous distinct strata of calp, and along with it a compact siliceous black carbonate of lime that receives a good polish, forming a handsome black marble.

It answers well to the description of the lucullite except that (owing probably to its containing a great portion of silex ?) it is very fusible. We might suppose it basalt, but it effervesces freely. Westward of this secondary, I fell in with the narrow strip of transition laid down in Mr. Maclure's map. In this near Germantown, is a wonderful formation of lignite resting in numerous varieties of Potter's clay comprising the compact, heavy, chocolate coloured, used for stone ware, the adhesive which cuts like putty, and a bright yellow ochre. The extensive iron beds, the limestones, the ochres of Stokes and Surry furnished objects of much interest. There abounds also in this region whitish shelly granite, full of decomposing feldspar and near it, as might be expected, very fine white clays. Near the blue ridge we met with a lofty precipice of "Copperas Rocks," some of them so far decomposed as to have fallen down in huge masses. In Surrey we found a bed of the earthy oxide of manganese; and in Stokes, a bed of plumbago of much the same quality as that in Wake, only not so slaty.

24. *Education.*—A committee of the Ohio Legislature to whom was referred that part of the Governor's message which relates to common schools, have (in their report) expressed it as their opinion, that the lands which have been

granted by Congress to that state for the support of schools, should be sold, and the proceeds vested in the stock of the United States, or in some other fund which shall be permanent and productive. The committee further reported, "that in order to collect information on the subject, submitted to their consideration, Commissioners ought to be appointed to report to the next General Assembly, a bill to establish and regulate common schools, accompanied by such information on the subject, as they may be able to collect."

25. *The blue Iris affords a good test liquor.*—Extract of a letter from Professor Olmstead of N. Carolina University. In my late experiments on the acids, wanting a test liquor, and red cabbage being out of season, I was induced to try the petals of the garden *iris*, then in blossom (I believe some people call it the *blue lily*, and others the flower-de-luce) I have never tried any test more sensible, or more elegant both for acids and alkalies. When prepared with care it is reddened by blowing through it, and still more by passing a stream of carbonic acid through it,—a sensibility which was confined by Bergman, and after him by Thomson and others to Litmus alone. Besides its greater delicacy, it has another great advantage over cabbage; its blue colour is permanent, or appears so, as far as I can judge from a tincture that has been kept for six or eight weeks; and from the size of the petals and the abundance of colouring matter they yield to diluted spirits, it is more convenient than violets. In a subsequent letter, Professor O. remarks: The colour faded after some weeks. It is necessary to mention that the petals afford the most delicate and sensible colour when they first put out; and the sensibility is further increased, by carefully selecting the part most richly coloured, and then, on infusing it, if the first tinge be greenish, by turning off the water and adding a new supply. For common experiments, however, the infusion will be sufficiently delicate and sensible without these precautions.

26. *Remedy for Hæmorrhage, especially Hæmoptisis.*—We have received from Mr. James H. Linsley of Stratford, the following statement of facts respecting the *Lycopus virginicus*, commonly called bugle-weed, and by some persons water-hoarhound. *It is*, says Mr. L. *found to be almost a sovereign remedy for internal Hæmorrhages.*

In consequence of a publication by Mr. L. in the Connecticut Herald, two years ago, about twenty persons afflicted with hœmoptisis, were restored to health by the use of the bugle-weed. The months of August and September are the proper time in which to collect the plant, of which a full description may be found in the books.

It grows spontaneously in most of the United States, in low and wet lands, and is a very common weed. The leaves are broad, and frequently of a bright purple; joints of the stem thicker upwards, stem quadrangular and branching, flowers opposite, sessile, white, and resemble those of the common hoarhound, (Marubium vulgare.) It begins to flower in August, and continues nearly through September—from eight to eighteen inches high.

Mr. L. remarks "I have been afflicted for some years with hœmorrhage from the lungs, and about five years since, was requested by Mrs. D. Porter, (sister of the late Pres. Dwight,) to drink a tea of the bugle-weed, made as strong as the common hyson-tea—to use it cold, and as often as I pleased. I did so, and found immediate relief; had no return of the complaint for two years—again resorted to the tea, and was again restored; and though I had bled for some days previous, had no relapse after using the tea. Whenever I perceived the symptoms of sudden bleeding, a violent flush in the face, pressure at the breast, &c. by drinking the tea, the symptoms were immediately dispelled. This I have done hundreds of times, when, I have reason to believe, that without its application, I must, in many instances, have raised blood."

"I feel sensibly cooler after drinking the tea. In complaints of this kind, the circulation of the blood being unequal, and frequently giving a high flush to the face while the body and limbs are frequently shivering with cold, it would appear as if the essential quality of this plant is, powerfully, to equalize the circulation of the blood."

"It is not productive of the same deleterious effects as *digitalis*, laudanum, &c. nor of any ill effects whatever, on me,

and I drank it more or less for five years, and on one occasion for three months together, as my only drink, both with food and otherwise; and what is remarkable, out of the multitude of persons whom I have known to use it, there is not one who is not happy to acknowledge its beneficial effects. Among them, I would beg leave to refer to a gentleman of eminence as a physician, in New-York, who addressed the following to Dr. Samuel L. Mitchell, a year after my paper had been copied into the Evening Post, and to which he doubtless alludes:"

"*New-York, Sept.* 5th, 1821.

"Sir,

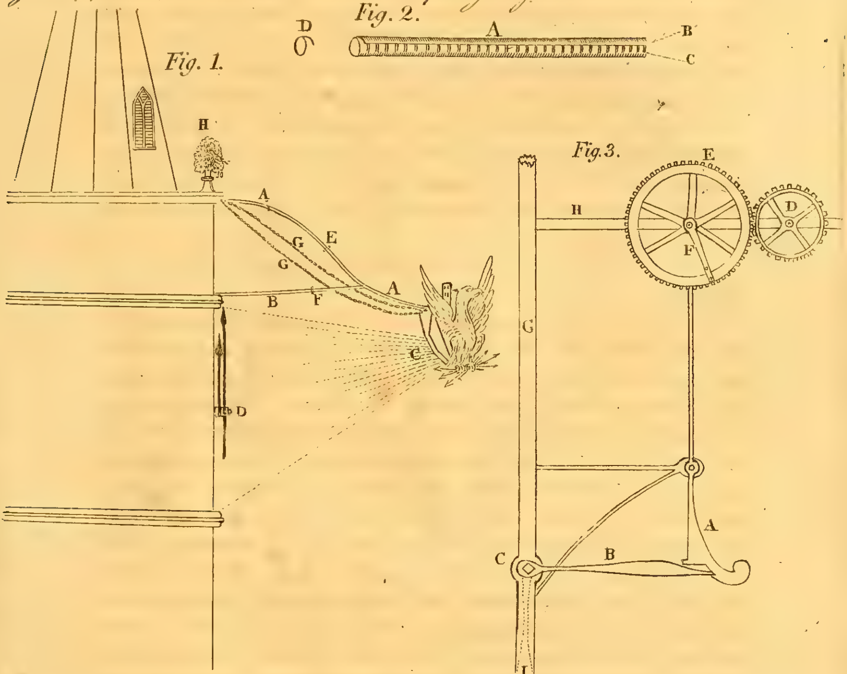
"I address you at the particular request of my son, the late Dr. John W. Wynkoop. His disease was consumptive, and in its progress he had repeated attacks of hœmorrhage from the lungs, or spitting of blood. To relieve this symptom, he drank a tea made of water-hoarhound, or Lycopus virginicus, called also Bugle-weed. It operated as a sovereign remedy against the inward bleeding, which it used to stop without fail; and it was his desire, during his last illness, that the beneficial effects of this remedy should be published to the world. His case affords confirmation to the statements that have already been made of its great virtue in hœmoptysis. My own observation shows that this native vegetable possesses similar powers in restraining blood from outward injuries: such as cuts and bruises, if applied to the wound in substance. Hoping this information may be serviceable to my fellow-creatures, I offer you the assurance of my respect.

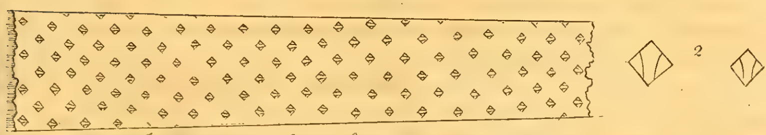
"PETER WYNKOOP."

The plant and its great efficacy as a *vulnerary*, have been known in England for more than a century; it is there called bugle-weed. The first information I can learn of its use in this country, was about thirty years since. It was then used by an Indian in Windsor, in this state, to stanch the blood in an external wound from a scythe. Its good effects here were equally surprising. In this case it was *bruised soft, and applied to the wound.*

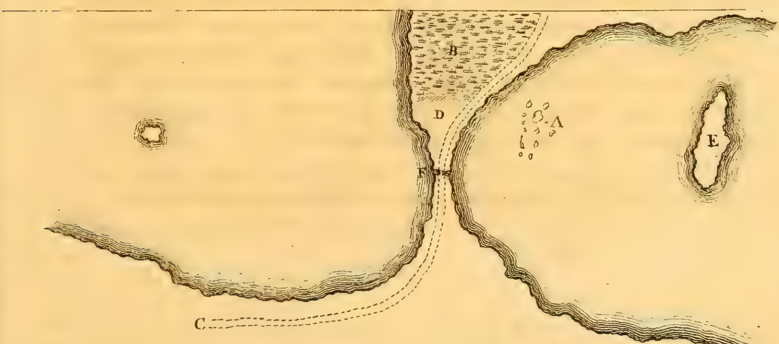
*Europœus is distinguished by the calyx being accuminate-spined, flowers small, whorled, and the plant generally smaller than the Virginicus.

Gas apparatus used in the Tron Steeple Glasgow – vid pa: 141.





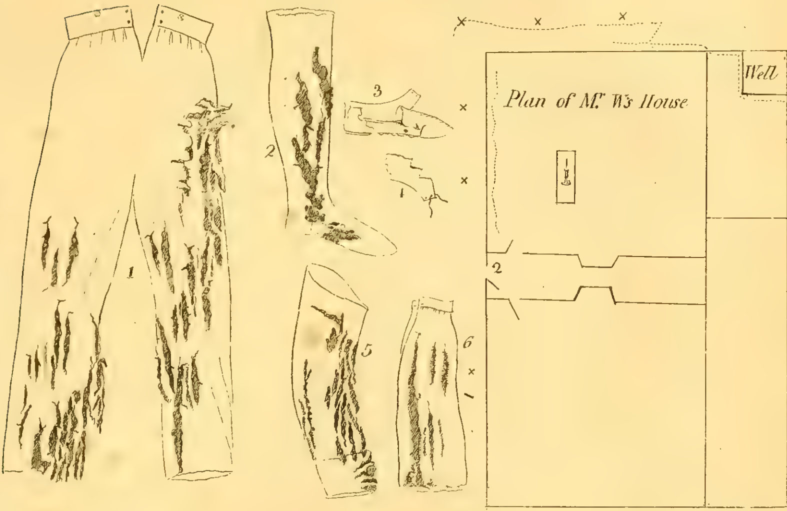
Impression in Sand Stone. – vid. pa. 155



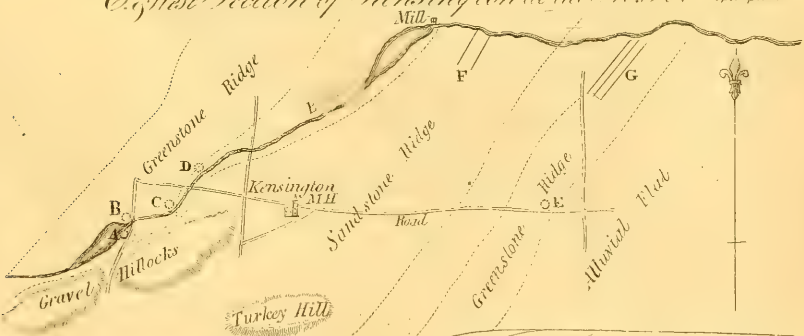
View of the junction of N. East & Little Ponds Salisbury Ct.
vid pa. 34

A. Doolittle sc.

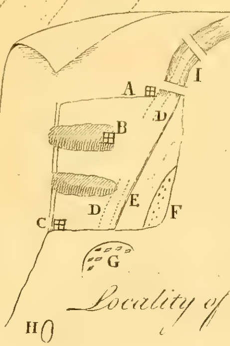
Mr. W's clothes as torn by the Lightning
vid pa 124



E. & West Section of Kensington at the M.H. vid pa 42



A Locality of the Sulphate
B Mill
C Locality of Coal
D ——— of Lead
E ——— of Zeolites
F ——— of Shale
G Strata of Sandstone under Trap



A. Grist mill
B. Oil mill
C. Saw mill
D.D. Vein of the Sulphate
E. Vein of Carb. Lime
F. Stalactites
G. Quartz crystals
H. Granite Block
I. Two Bridges

Locality of the Sulphate.

Electro-Magnetic Apparatus

fig. 2.

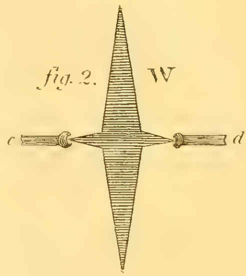
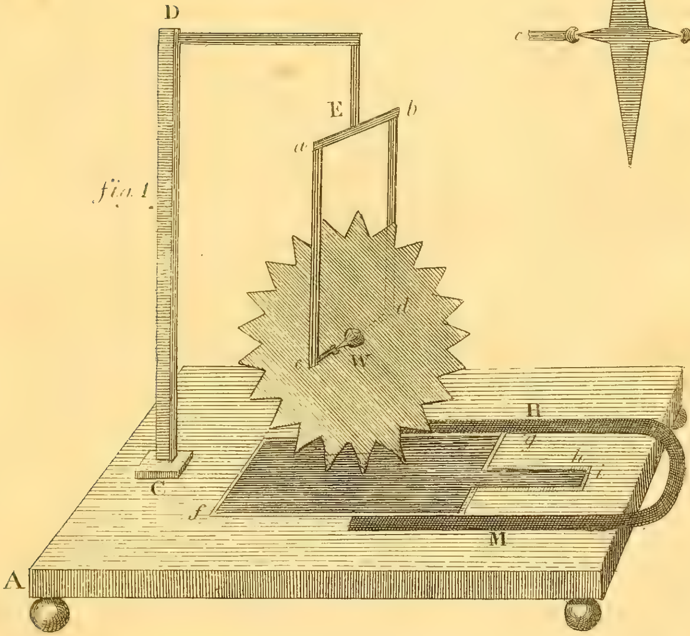


fig. 1.



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ERRATA IN MR. NUTTALL'S CATALOGUE.

(The Editor was out of town when this piece was struck off.)

Pa. 287,	line 7,	from the top, for	quandripartitis, read *quadripartitis.*
	20,	"	pumilla, read *pumila.*
	4,	bottom,	rupous, read *rufous.*
288,	13,	from top	Cencocephala, read *Leucocephala.*
	2,	from bottom,	Browner, read *Brownei.*
	1,	"	Diadia, read *Diodia.*
289,	3,	from top	Ludiwigia, read *Ludwigia.*
	22,	"	Ipomao read *Ipomoea.*
		"	obicularis, read *orbicularis.*
	25—26,	"	T. read *I.*
		At the bottom of the page after "aspect," read *instead of*	
290,	2,	from top, for	The read *the.*
	21,	"	V. read *O.*
292,	23,	"	St. read *H.*
	6,	from bottom,	acc. read *occ.*
	2,	"	surpuraceous, read *furfuraceous.*
294,	11,	from top,	ris, read *sis.*
295,		at bottom,	nelumbium, read *Nelumbium.*
296,	11,	from top	Jamai, read *Jamaica.*
297,	13,	from bottom,	Tripertella, read *Tripterella.*
	6—7,	after petiolis and pedunculis, dele ,	
298,	3,	from top	ablong, read *oblong.*
299,	17,	"	408, read 508.
300,	11,	"	Ruhnia, read *Kuhnia.*
	31,	"	locevigata, read *lævigata.*
302,	3,	"	sprengel, read *Sprengel.*
	11,	"	tracheliflorus, read *tracelifolius.*
	12,	"	biclens, read *bidens.*
302,	2,	"	Segnegata, read *Segregata.*
	5,	from bottom,	Cateral, read *lateral.*
303,	24,	from top,	Ephorbia, read *Euphorbia.*
304,	4,	"	Diaecia, read *Diœcia.*
	10,	"	after Indians, read *and.*
	16,	"	for cinnamonea, read *cinnamomea.*
	17,	"	Polypodicum, read *polypodium.*